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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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How to Lose Friends and Irritate People

THE reduction in K.L.M.'s traffic rights at Singapore will be remembered as one of the worst-managed scenes in the drama of international air transport. A conflict between friends is deplorable; one in which both sides lose is tragic.

Two quite separate issues were involved: one was the treatment accorded to K.L.M.; the other was the wider problem of easing political restrictions on civil aviation. *Flight* has already noted that the Dutch Government emerged with little credit for their churlish response to the impending reduction in K.L.M.'s traffic rights. In the first place, no recognition was given to Britain for having aided K.L.M. at a moment of dire distress. Secondly, an embarrassingly provocative attitude was adopted. (For instance, Dr. Luns attributed the unfavourable developments to the absence of the British Foreign Secretary, although he must have known perfectly well that the matter was being handled by the Prime Minister. The occasion was also used to circulate the idea that perfidious Albion was to blame for the loss of Indonesia.) And finally, the Dutch Government's allegation that K.L.M.'s rights in the Malayan Peninsula had been reduced from the pre-Indonesian level can only be interpreted as deliberately misleading. Equally misleading was the assertion that Britain's action was precipitate, for the intention to reduce K.L.M.'s temporary rights had been announced ten months before.

But the Dutch loss is not Britain's gain. The Foreign Office has failed either to present this country's case or to refute the Dutch allegation that advantage was being taken of K.L.M.'s position. Consequently the British action has received a poor showing, even in Fleet Street. A more serious objection is that the line taken by the Foreign Office has left Britain vulnerable to allegations of protectionism. Ten years ago—even as recently as five—it might have been true that our best policy was one of restriction. But times have changed: privileged traffic rights are dwindling as colonial territories become independent; increasing aircraft range allows rival airlines to overfly British airports; and, most important, B.O.A.C. will be able to regain the ground lost in bygone years only if new traffic is found outside the ranks of those who travel to or from these shores. These changes all call for concessions from others. And these concessions will not be forthcoming while Britain is branded as a reactionary.

A Thought Before Supersonics

WITHIN four days of the Institute of the Aeronautical Sciences having deliberated upon the future—supersonic—generation of transports calamity had overtaken two of the new airliners that comprise the generation now coming into service. In an Electra sixty-five people were killed in distressing and mystifying circumstances; and about twice that number, in a Boeing 707, suffered the ordeal of an involuntary 24,000-ft dive towards the sea. Mercifully, in this latter instance physical injury was slight; but the mental stress imposed on those 120 people is a matter which invokes the same grave consideration that is demanded by recurrent accidents at take-off and landing.

Of the supersonic airliner a delegate to the I.A.S. meeting remarked, "The speed potentials of this vehicle will keep us driving until it is an operating fact." *Flight* agrees. But although the public may come to accept windowless cabins and steep angles of climb it will never accept a system of transport which fails to exploit every means of enhancing safety as well as speed.

FROM ALL QUARTERS

Progress in Defence

THIS year's Defence White Paper, published last Tuesday, forms a progress report on the five-year defence plan announced in April 1957 and as such contains nothing startling. It records the TSR.2 development as a tactical Army-support aircraft and Canberra replacement, and the adoption of the A.W.A. 660 to supplement the Beverley in Transport Command; in addition it says that a small number of long-distance air freighters, "capable of carrying bulky equipment such as guided missiles and their associated radar vehicles," is to be ordered. The Minister of Defence, Mr. Duncan Sandys, was to give more precise details of this new aircraft in a subsequent Parliamentary statement.

On missiles, the White Paper has come down firmly for Blue Streak as "the type of missile best suited to British needs," and its development is therefore proceeding. A more advanced Bloodhound is being developed; deliveries of Thunderbird have started to the Army; and the Lightning, after coming into service next year initially equipped with Firestreak, is to have "a more advanced weapon." The Navy's recent successful Seaslug trials are referred to, and it is stated that the four guided-missile ships of the County class are in addition to have Seacat for close air defence.

The White Paper expresses some concern about R.A.F. recruiting, both for aircrew and for certain specialist ground branches. On finance, it records that the Defence Estimates for 1959-60, at £1,514m, come to £20m more than the expected actual expenditure for the current financial year.

Martin-Bakers for Germany?—

AS we closed for press with this issue, the Martin-Baker Aircraft Company were believed to be on the point of obtaining a contract for a large number of late-model ejection seats for Western Germany. It is unofficially reported that the British seats are likely to be retroactively installed in Luftwaffe T-33s, F-84Fs and possibly Sabre 6s. The total number of seats would probably exceed 1,000 and the contract is expected to be worth some £2m.

—and German Starfighters

IT was confirmed in Bonn on February 6 that the West German defence ministry are about to sign contracts for some 300 F-104 Starfighters for the Luftwaffe. As we reported on October 31, this type was chosen after a two-year evaluation of 14 competing types (three British, two French, one Swedish and eight American).

Herr Franz-Josef Strauss, the Defence Minister, stated that 96 aircraft would be purchased from Lockheed. These would comprise 66 "multi-purpose single-seaters" and 30 two-seat F-104Bs. The latter, being a type already established in production, would be delivered from December of this year, at a mean price of 5.2m DM (about £445,000) each. The single-seaters will "be brought up to 1961 standard" by the incorporation of advanced electronics, new fire-control (reported to be capable of handling the T-171 gun, Sidewinder IR missiles and GAR-3, 4 or 9 missiles), together with an upward-ejecting seat (possibly by Martin-Baker). It has been unofficially suggested that there will be other changes, including a wing of increased area. At least 200 of these advanced single-seaters will be built in Germany. All engines will come from General Electric. Total cost of the programme will be approximately £128m.

Preserving the Veterans

WHAT is described as "a first practical step towards the establishment of a National Aeronautical Museum" was taken at a meeting held recently at the Royal Aeronautical Society, when it was decided to compile a register of all aircraft of major historical importance in Great Britain, with a view to their preservation. The Society's president-elect, Mr. Peter Masefield, was in the chair and the meeting was attended by 26 representatives of Government departments and other public bodies interested.

A sub-committee was formed under the chairmanship of A. Cdre. A. H. Wheeler, trustee of the Shuttleworth Trust (one of the four existing collections of veteran aircraft), to supervise the preparation of the register; and the Society would like to hear from anyone who possesses old aeroplanes or aero-engines, or can inform it of their locations and conditions, so that they may be added to the register. Information should be sent to Mr. A. S. C. Lumsden, secretary of the committee, at the offices of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1.

The other collections referred to are those in the Imperial War and Science Museums and the aircraft from the Nash Collection of Early Mechanical Transport. Since the Society acquired the latter in 1953, so that they would remain in this country, it has hoped that they would eventually form part of a national aeronautical museum.

There are many difficulties in the way of such a project—chiefly finance and accommodation—but these are being tackled; and the decision to compile a register will at least mean that the whereabouts of all historic aircraft in this country is known, and plans to ensure that they are not destroyed can be put in hand.

[*The possibility of a national aviation museum was discussed by A. Cdre. Wheeler in an article in "Flight" for January 30.*]

French Aircraft Abroad

THREE Sud Vautours based at Cognac have lately flown to Ethiopia (Djibouti) in about six hours. Demonstrations at the Ethiopian Air School, Addis Ababa, were attended by the Emperor Haile Selassie. It is also learned that 24 sets of MS.760 Paris parts, of 48 sets ordered, have been delivered to Argentina, and that the MS.1500 Epervier has finished its constructors' trials.

Swiss Evaluations

SWITZERLAND is to carry out a series of tests of American, Italian, French and Swedish fighters during the next few months to decide which would be most suitable for the Swiss Air Force. The aircraft involved are the Grumman F11F-1F Super Tiger, Fiat G.91, Dassault Mirage III and Saab J-35 Draken. No British types have been mentioned. A £26m order for 100 Hawker Hunters is in course of delivery to the Swiss Air Force.

Guild 1958 Awards

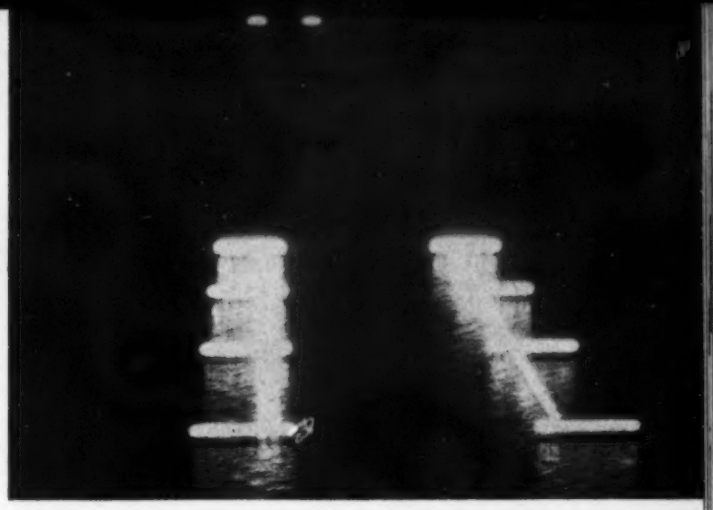
AWARDS of Trophies and of the Derry and Richards Memorial Medal for 1958 have been announced by the Guild of Air Pilots and Air Navigators. They are to be presented at a reception to be held in London on April 2.

The Cumberbatch Trophy, donated by Miss Alice Cumberbatch in 1931 for the promotion of reliability in civil aviation, goes to Trans-Australia Airlines and the citation says: "From the commencement of operations in February 1945 up to June 1958, Trans-Australia Airlines' flying in scheduled air services totalled 984,595 hr and 166,841,754 miles, without an accident involving death or injury to a passenger. Trans-Australia Airlines have been responsible for operating the Australian Flying Doctor services since 1949, conveying doctors and patients to and from remote areas, with limited facilities."

The Johnston Memorial Trophy, awarded for "the most outstanding feat or performance in aerial navigation, for the development of principles of air navigation, or for flights involving the development of the technology of navigation," goes to the captains and navigational crews of the A. and A.E.E. engaged on test and evaluation flying of the Dectra navigation system. Their names are Mr. H. A. Purvis, Mr. W. Stuart, W/C. A. H. Gibb, S/L. D. F. H. Grocott, S/L. E. W. Hare, and F/L.s H. Pope, H. Rumble and H. G. Clark.

The Brackley Memorial Trophy, originally for flying-boat

***RETIREMENT** of Mr. P. V. Hoare from Westland Aircraft Ltd. was marked with the presentation, by his colleagues, of a portable typewriter. Mr. E. C. Wheeldon, Westland's managing director (left), did the handing-over. Mr. Hoare had a long career in Government service and was appointed assistant to the managing director of Westland Aircraft in 1951. He has also been, and will continue as, a consultant*



CATALINA AND MARLIN flying-boats figure in these new pictures. On the left a "Cat" amphibian is being used by the Pakistan Shell Oil Company in a search for oil in the Bay of Bengal. On the right a Martin P5M Marlin of the U.S. Navy is trying out the new Seadrome lighting system at Norfolk, Virginia. Special 500 W bulbs have been developed for the approach lights by the General Electric Company

operations but now awarded for outstanding achievement in the operation of aircraft over water, goes to the Comet and Britannia Flights of B.O.A.C. "for their part in the development of turbine-powered flight culminating in the introduction of scheduled passenger services with both turboprop and turbojet aircraft over the North Atlantic in 1958."

The Derry and Richards Memorial Medal has been awarded to Mr. T. W. Brooke-Smith, chief test pilot of Short Brothers and Harland Ltd. The citation states: "In making this award the Guild noted that in the last ten years Mr. Brooke-Smith has been responsible for the test flying in a progressive programme of research aircraft directed towards high speed and vertical take-off and landing. The first flight and much of the development flying in a series of experimental swept-wing and VTO aircraft have been performed by Mr. Brooke-Smith, including the vertical take-off and landing in free flight of the Short SC.1."

The newly instituted Award of Merit goes to Mr. E. B. Trubshaw, deputy chief test pilot of Vickers-Armstrongs (Aircraft) Ltd., for "his meritorious service" to British aviation as a test pilot over several years, including test-flying of the Vickers Viscount and culminating in the prototype development flying of the Valiant. The citation adds: "Mr. Trubshaw's work has earned high commendation in a number of quarters, for the brilliance of his flying coupled with a systematic follow-through of development." The new award is conferred on freemen of the Guild and carries with it a silver medal.

Sir Raymond Quilter

WE regret to record that Sir Raymond Quilter, chairman and managing director of the G.Q. Parachute Co. Ltd. and a director of Folland Aircraft Ltd., died suddenly last Saturday in Ipswich Hospital, near his home at Woodbridge, Suffolk, at the age of 56.

He took up flying in 1927 and became known as "the flying baronet," owning two aircraft. In 1928 he started designing parachutes, carrying out many descents himself, including some of the earliest delayed free falls. During the war he was chairman of the parachute panel of the Airborne Forces Committee; and in 1950 he was awarded £27,500 by the Ministry of Supply for his exceptional services to paratroops.

In May 1954 Sir Raymond gave a spectacular demonstration at Dunsfold of the world's first retractable braking parachute, designed by his company, when he drove the John Cobb Napier-Railton, equipped with it, along the runway at fast runs of up to 135 m.p.h.

R.A.E. Prizegiving

A DISCONTINUATION of the B.Sc. (London) degree course at the Royal Aircraft Establishment Technical College in favour of courses leading to the Diploma in Technology was announced by the College Principal, Mr. R. D. Peggs, at the annual prize distribution on Friday, February 6. The guest of honour, Lord Hives, said that the Diploma in Technology was not intended to compete with or replace any existing award, but that it was more closely associated with industry and more flexible in entry requirements than was a university degree.

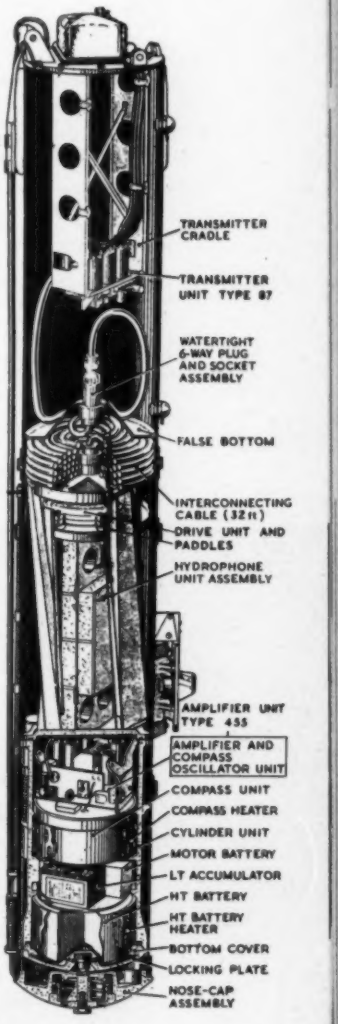
Other speakers on this occasion were Mr. G. W. H. Gardner, director of R.A.E. (who was to be invested with his K.B.E. the following Tuesday); Sir William Farren, chairman of the College Advisory Board; and Mr. M. E. Ventham, president of the Students' Union. The prizes, presented by Lord Hives, included:

Grinsted Prize for best student of year, J. B. Hargrave; Perring Prize for student apprentices, A. L. Bushell; Farren Prize for craft apprentice student, R. Maynard; Hilda Lyon Prize for scientific assistants, K. Green; Principal's Prize for president of Students' Union, L. D. Hooper; A. H. Hall Prize for aeronautical engineering (student app.), P. H. Gale; Sydney Smith Prize for aeronautical engineering (craft app.), P. D. N. Munro; A. A. Hall Prize for D.O. practice and design, J. D. Knuckey; Shop Stewards' Prize for workshop technology (craft app.), P. D. N. Munro; Mullard Prize for advanced electronics (student app.), J. B. Hargrave; Mullard Prize for electronics (craft app. student), R. S. Beaumont; Tom Nevard Prize for social activities, M. J. Wilkey; Wilson Prize for athletic activities, B. S. Clinch; Staff Prize for humanistic studies (student app.), P. Judson; Staff Prize for humanistic studies (D.O. app.), K. Laight.

Sonobuoy Disclosures

WITH the news that Ultra Electric Ltd., of Acton, have received a further order for sonobuoys from the Federal German Government (bringing orders received from West Germany to over £500,000) comes the release of new technical information. The German orders, incidentally, cover also the supply of SARAH radio rescue beacons, direction finding equipment and test equipment.

The sonobuoys can be dropped from between 150ft and 10,000ft at an aircraft speed of 150-250 kt. Range for effective radio signals is 10 n.m., with the receiving aircraft at 500ft and 20 n.m. at 2,000ft, increasing with height. When the buoy strikes the water the detailed operation is as follows: The parachute (for aerodynamic stability) is cast off; likewise the nose cap (so that the hydrophone and lower cylinder descend to the limit of a six-core cable). The upper canister remains floating, and the antennæ automatically swing up vertically. Next, the battery supply switch is closed, thus starting rotation and radio transmission. On release from the upper canister, three articulated, sprung paddles appear radially from the lower cylinder. A drive, through gearing, attempts to rotate the paddles, but water reaction causes the whole assembly to rotate at 3 r.p.m.; the paddles also contribute to stabilization and reduce drift. A magnetic compass holds the compass unit in line with the earth's horizontal magnetic field. The compass unit is fitted with capacitor vanes, which may vary the capacitance of vanes fixed to the lower cylinder. This capacitance variation controls the frequency of the compass oscillator, and this signal, together with any noise picked up by the hydrophone assembly, passes through the cable to the radio transmitter. While in the aircraft the compass and batteries are kept at a suitable temperature by strip heaters supplied by the 28V aircraft batteries.



The Ultra sonobuoy seen in part-section

FROM ALL QUARTERS . . .

A.W.A. Test Pilot

A NEW member of the Armstrong Whitworth Aircraft test-pilot staff is C. W. ("George") Simpson, who served with the R.A.F. Handling Squadron at Boscombe Down from 1956 until he recently left the Service. He joined the R.A.F. in 1942, became a flying instructor in Canada and in 1945 transferred to the F.A.A. After demobilization he went to Loughborough College and subsequently to Bristol Aero-Engines as a technical assistant. Then he rejoined the R.A.F. in 1950 and was an instructor in Flying Training and Coastal Commands before his posting to test-flying duties at Boscombe Down.

Mr. Simpson

Another "Small World" Attempt?

HOME again last week were three of the four members of *The Small World* balloon crew, whose part-air, part-sea westward crossing of the Atlantic recently made news. It now appears that provided their sealed-barograph trace is accepted by the F.A.I. they will have broken the 45-year-old German duration record of 87 hr in Class A-10 (balloons under 4,001 cu m) and, automatically, the duration record in all other balloon classes; this will include the Russian 69 hr 20 min in 1941.

In London last week they announced their intention of a new attempt next year with a larger balloon, unless a competitor—J. M. Ansaldo, Iberia (Spanish Airlines) chief of flight operations—beats them to it. Meanwhile they are embarking on a lecture tour, beginning at the Royal Festival Hall, London, tomorrow, February 14. Next week they will be at York, on the 15th; Newcastle, 16th; Bristol, 17th; and Jersey, 19th.

IN BRIEF

The Federal Association of the German Aircraft Industry is to stage an exhibition of aircraft equipment and accessories at Hanover Airport from April 26 to May 5.

* * *

Bob Timm and John Cook landed their Cessna 172 (picture, *Flight*, January 30) at Las Vegas last Saturday after remaining airborne for 65 days. They were refuelled and provisioned twice daily by a high-speed bowser on the runway.

* * *

One Twin and two Prestwick Pioneers for the Royal Malayan Air Force were formally received at Kuala Lumpur on February 8 by the Malayan Defence Minister, Dato Abdul Razak. The departure of the aircraft from Prestwick was recorded in *Flight* for January 9.

* * *

The U.S. Navy's R4D *Que Sera Sera*, which landed at the South Pole on October 31, 1956, with the first men to tread the snows there since Capt. Scott's expedition of 1912, is being taken back to the United States by sea for preservation in the museum of the Smithsonian Institute.

* * *

This year's International Plastics Exhibition at Olympia, London, from June 17 to 27 is to show plastic materials, machinery and finished products from 15 countries. The exhibition, organized by our associated journal *British Plastics*, will have a total floor space of more than 270,000 sq ft and over 90,000 visitors are expected.

* * *

The U.S. State Department has produced a recorded transcript of an R/T conversation said to have taken place between Russian pilots during an attack which the Americans allege they made on a C-130 Hercules which crashed near the Turkish - Armenian border last September. The Americans have refused to divulge the source of their transcript, which the Russians say is a fake.

* * *

Among those named as committee members for the World Congress of Flight (Las Vegas, Nevada, April 12-19) are Miss Jacqueline Cochran, president of the F.A.I., and Dr. Theodore von Kármán, chairman of the NATO Advisory Group for Aeronautical Research and Development. The general chairman of the Congress, Mr. Edward P. Curtis, said recently that 88 companies (including a number of foreign ones) had agreed to exhibit and approximately 80 per cent of the indoor exhibition space had already been allocated.

SIR DERMOT TAKES A TRIP ABROAD

IF the Chief of the Air Staff keeps a scrap-book, these pictures from his recent 22,000-mile tour of R.A.F. units overseas will probably go into it. At right, Marshal of the R.A.F. Sir Dermot Boyle has just dismounted at Luqa from the five-star Canberra B.6 he piloted and is being greeted by Air Marshal C. E. Chilton. At far right, the C.A.S. inspects a guard of honour at R.A.A.F. Butterworth, Malaya. Below left, the R.R.A.F. Chief of Air Staff, A. V-M. E. W. S. Jacklin, introduces Sir Dermot at Salisbury to (from right) G/C. H. Hawkins, S.O.A., who is wearing the new R.R.A.F. summer uniform; G/C. A. M. Bentley, S.A.S.O.; and the U.K. High Commissioner, Mr. M. R. Metcalf. Below right, conversation-piece with Mr. Krishna Menon, the Indian Minister of Defence, in New Delhi.

Soon, as from April 1, to be a regular sight at Haneda Airport, Tokyo, are B.O.A.C.'s Comet 4s, one of which is seen there at the conclusion of the first eastward proving flight. Haneda is one of the few airports outside America with the finger-and-gate terminal system

"FLIGHT" STORY AND PICTURES
By J. M. RAMSDEN

B.O.A.C. Comet 4 Proving Flight to Tokyo : Part 2

EASTERN ROUTES JET

THIS is the second of two articles about the forthcoming B.O.A.C. Comet 4 services to the Far East. The first, published last week, discussed the commercial opportunities; this instalment describes the operational aspects.

THE proving flight which we accompanied was the first of six which will be operated to Tokyo before services begin on April 1. There were five complete crews on board—36 crew-members under the command of Capt. R. C. Alabaster, made up of four captains, five first officers, five navigating officers, seven engineering officers, nine stewards, and five stewardesses.

Comet 4 flight-planning and cruise-control techniques on the eastern routes differ little from those developed for North Atlantic (see *Flight*, October 24, 1958). The basic jet climb-cruise descent profile is—by previous turbine standards and even some present ones—relatively simple.

Fuel uplift is estimated for take-off, climb and cruise-climb to overhead destination (the precise quantity depending on stage length, en route winds, temperatures, etc.), *continuing the cruise-climb from that point* and arriving 1,000ft over destination with a fuel reserve of 6,000 kg (7,000 kg at certain places and 8,000 kg in Europe). This reserve can be used en route to provide against contingencies such as engine-out cruising, non-forecast icing, winds more adverse than forecast, and so forth. The only stipulation is that not less than 2,300 kg shall still be left in the tanks on arrival 1,000ft overhead at the alternate. Even assuming that the 3,700 kg balance (6,000 kg minus 2,300 kg) is used up by en route contingencies—an extremely unlikely event—2,300 kg still allows for a descent to 1,000ft (1,250 kg), a circuit to land (550 kg), and residual fuel (500 kg). In terms of holding at (say) 20,000ft, 6,000 kg (less 500 kg residual fuel) is worth 1½ hr holding at a fuel consumption of 60 kg/min at that height.

As Far East Comet 4 crews become more experienced—and the air traffic controllers likewise—this ample 6,000 kg reserve (which is incidentally 1,000 kg more than is flight-planned by Atlantic Comet 4 crews) will no doubt be pared down to the benefit of payload, which at present is of the order of 7,350 kg (16,200 lb).

There are no range limitations on the Far East sectors to be operated. Average Comet 4 stage distance on the proposed eastern-routes B.O.A.C.-jet network is about 900 n.m. This means that the Comet 4's highest Mach number cruise, 0.73M (15 per cent above minimum-drag speed) is used to give the best combination of speed and range. Sometimes on the North Atlantic run 0.69M—which is 9 per cent closer to the Comet's V_{MD}—is used to get endurance at the expense of speed. Maximum fuel tankage, 32,000 kg, should in practice never be required on the eastern routes. The pilots have a table for a maximum endurance cruise actually at V_{MD} (0.66M), but this will not normally be used.

In passing it is worth commenting that the 900 n.m. average stage distance of the Comet 4 on the eastern routes appears to be on the low side. One would have expected that the fast Comet 4 would be used to best effect on the longer sectors. There were, indeed, some feelings among the crew on the recent proving flight that a number of the proposed sectors are unsuitably short. It is thus with interest that one anticipates a B.O.A.C. announcement of express long-haul Comet 4 schedules to the Far East. A routing through even three intermediate places (e.g. London - Beirut - Karachi - Hong Kong - Tokyo) would still be well within the Comet's capabilities.

The same cruise-control chart developed for North At'antic Comet 4 operations is used on the eastern routes. Reduced to its simplest terms, cruise control can be summed up as: "weight fixes height, temperature and flight-plan speed fixes r.p.m." As discussed above, speed is normally 0.73M or 1.15V_{MD} and the required r.p.m. are read off the chart for the appropriate outside

Left, the Comet 4's particular cachet is the steep climb-away, seen here in progress over Kowloon, Hong Kong. Right, the moment of flare-out at Hong Kong, 50ft over the threshold. Capt. A. G. Payne is in command. Note the slight bank to compensate for crosswind

EASTERN ROUTES JET . . .

air temperature. On the eastern routes this is naturally generally higher than over the North Atlantic; thus, in general, an r.p.m. of 300-400 more is required for eastern operations. But only very rarely is the full cruise rating of 7,360 r.p.m. required. The engineer passes the navigator a weight statement every 1,000 kg of fuel burn-off, i.e., every 15 to 20 minutes, from which the "Howgozit" is plotted by the navigator and the r.p.m. adjusted by the captain.

There should be no problems on the eastern routes about obtaining clearances for cruise-climbs. Even on the North Atlantic cruise-climb clearances are given now that A.T.C. are more used to the Comet—provided always that no airspace has been blocked off for military jet traffic. This last problem should not arise on the eastern routes, except on the first sectors traversing the Europe - Mediterranean area, and possibly also in the Hong Kong - Japan (via Formosa) area.

It is not easy to obtain a cruise-climb in areas where military jets abound, even though the Comet 4, for the time being, has the upper European and S.E. Asian civil airspace to itself. It may be less easy when the Comet 4 is only one of several civil jets seeking cruise-climb clearances. Everything depends upon the outcome of the international discussions—the early phases of which are in progress as this issue of *Flight* is published—on a standard civil navigation aid.

A brief word about Comet 4 let-down procedures is appropriate here. The so-called jet penetration is not being used, and air-braked descents from holding height are at present the exception rather than the rule: the Comet is operating standard piston let-down patterns. But the efficiency of the operation would be improved if faster descents could be accepted, and B.O.A.C. are proposing a standard jet letdown procedure which, it is hoped, might form a basis for international agreement. The essence of the idea is that air traffic controllers must know exactly how long

Typical scene in the Comet 4's forward cabin, which for 14 days was the comfortable common-room for the off-duty trainee crews. Commander of the flight, Capt. R. C. Alabaster, is on the right

it takes a given jet to arrive on the glide path from the moment it is taken off the stack. This time will of course differ for each jet: the Comet 4 can accept, say a 3,000ft/min rate of descent while the 707 (which is stressed to extend its undercarriage at cruising speed) can descend at thrice the rate.

The strongest single impression of the Comet 4 which one gains from talking to crews (as well as just flying in the aircraft) can be summed up in one word: performance. The take-off and steep climb-away, developed at L.A.P. and New York for noise-abatement reasons, is standard practice at every airport. It is done because it costs nothing (except perhaps a word of explanation from the captain over the passenger-address system); it provides uniformity of technique important in an aircraft which, if the nose is not kept up, can quickly rocket past the undercarriage-down limit speed of 125 kt; and it is a mark of respect to possibly noise-conscious airport communities. Besides, the Comet's greatest asset—power—is worth showing off.

There are only two airports on the London - Tokyo route where the Comet 4 is unable to take-off full weight. These are Colombo (Katunayake) and Kuala Lumpur. Both are hot airports with lengths, respectively, of the order of 6,000ft. At no other airports do the take-off charts show any material limitations in field length. The work of extension and strengthening, seen in progress at many airports, will obviously be mere bounty for the Comet.

The crew-training procedure used on the first Tokyo proving flight was arranged so that each of the four captains on board —one of whom had considerable previous Comet 1 experience and each of whom had several year's experience of the route—did eight take-offs from the left seat, and watched eight others from the navigator's post (i.e., looking over the pilot's shoulder). Likewise he did eight or nine let-downs and landings and watched the same number. Capt. Alabaster sat in the right-hand seat as check pilot, and one of the first officers was always in the jump seat. The general idea was to give everyone a go into and out of the less straightforward airports (at Hong Kong and Teheran, for instance, each pilot did two landings and take-offs) and had at least a look at the "standard-pattern" at straightforward places such as Delhi.

Before the proving flight each crew member had undertaken conversion-flying in four phases lasting a total of 7-12 hr depending on the pilot (the average was 10 hr). Conversion-flying is as follows:—

(1) Familiarization handling, including the 1.12 Vs stick-shaking stall in various configurations, and the 0.82 M "death dive" with the auto-trim circuit-breaker out to get the feel of compressibility buffet. (2) Circuits and bumps from Bedford airfield lasting about 1½ hr. (3) Landing without flaps and in other configurations, and overshoots on three and two engines—another detail of about 1½ hr. (4) Comprehensive night-flying programme, also lasting about 1½ hr. (5) A final check flight, on completion of which the pilot qualifies for his Comet certificate, though he cannot carry passengers until he is route-cleared.

The recent proving flight offered a good opportunity for an outsider to assess the value of a flight engineer in the cockpit of a jet airliner. The "third-man" controversy has been less acrimonious in Britain than it has in America, probably because B.O.A.C.'s policy (though not, it seems, B.E.A.'s) is quite definite: there shall be a fully qualified flight engineer in all the Corporation's new airliners.

In the Comet 4—as in the mock-up of the VC-10—there is a comprehensively equipped flight engineer's station. The man who sits at this station *could* be a junior pilot with flight-engineering qualifications; but it is difficult to see how such a man would have the seniority and experience—and, more important, the dedication—to carry out his responsibilities competently. The Comet 4 flight engineer's duties begin on the ground with the supervision of refuelling and of the transit check. In flight he is responsible for fuel management, which requires the keeping of a fuel-usage record and the passing of a weight statement every 15-20 minutes (every six minutes during the more thirsty climb) to the navigator. He must also watch fuel temperatures: this is a critical duty on a high altitude jet airliner, the aim being to maintain inlet temperatures at plus 5 deg C, and tank temperatures at no less than minus 50 deg C. He must also watch electrics, hydraulics, pressurization and so forth, while continually keeping an eye on cabin temperature distribution—a job which requires some skill and experience if passenger complaints are to be avoided.

To put all this on record is not to put across a big flight engineer's line: there appeared to be unanimity among the Comet 4 pilots that the job of flight-engineering is for the specialist.

A sector-by-sector report of the first proving flight, picking out from *Flight's* notebook the significant highlights, may help to bring the flight to life.

London - Zurich. A short sector—we have to flight-plan so that landing weight is not exceeded (as on any flight of less than 4½ hr). Military air exercises in progress: five A.T.C. clearances in 15 minutes in the Zurich F.I.R. A Swissair DC-7C sails past on a reciprocal 1,000ft below us to the right, a handsome sight against the thawing snow-clad foothills of the Alps. The engine blow-off valves seem extremely noisy as, with engines throttled, we wait our turn to approach. Flaps fully down, a long low approach to 50ft—then suddenly full power, flaps up, and a steep urging climb away with sun and cloud flashing on the wing skin. When we leave Zurich we are given a tremendous wave-off by everybody, including a chef who is waving his frying pan.

Zurich - Istanbul. A 1,159 n.m. stage. Military exercises over North Italy require a re-routing via Florence and Brindisi. The "B.O.A.C." on the inboard side of the wing nacelle tank is illuminated in darkness by our flashing red anti-collision beacon on the top of the fuselage. Navigation methods on this route: VOR, NDBs, radio ranges, ILS.

Istanbul - Teheran. A 1,099 n.m. stage. Poor HF communications preclude a weather report until we are within VHF range, though we are still at 38,500ft. Mehrabad report a 450ft cloud base—below limits. We decide to use our fuel reserves planned for practice letdowns at Teheran to press on to Karachi. One of the off-duty pilots makes a quick rough and ready calculation: "We uplifted 24,500 kg fuel; let's say we used 4,000 kg to top of climb and 3,600 kg/hr on the cruise. We've been going 2½ hr—that leaves us—let's see—that leaves us four hours' fuel. We're laughing, aren't we?"

Fifteen minutes later Teheran advise us that their weather has lifted, so we turn back, make two practice approaches and overshoots (no ILS or GCA at Teheran: we let down through cloud by beacon) and land. Navigation on that sector was by NDBs, radio ranges and Teheran's VOR. It is cold at Teheran, and the frost on the nacelle tanks is unmelted as we depart. Climbing

The descent to Manila, with Capt. L. Arthur in the left-hand seat. Capt. R. C. Alabaster — who commanded the first training and proving flight to Tokyo —is in the co-pilot's seat. Height reads 16,400ft, I.A.S. 220 kt (standard Comet 4 descent speed), r.p.m. 3,850 inboards and 6,900 outboards

EASTERN ROUTES JET . . .

through the rain we watch the raindrops swirl, almost stagnant, on the upper surface of the deflected flaps.

Teheran - Delhi - Karachi. The sparseness of en route navigation aids is felt on this sector. On nearing Zahedan NDB we find that it is not on. The next NDB, Nawabshah, is weak and obviously unreliable. "I think it is only 100 Watts," says one of the off-duty captains, "about enough to light my 20ft living-room at home." As the navigator takes an astro fix we hear from Delhi that the weather at our ETA will be foggy, giving 400 yd viz., with eight-eighths cloud at 300ft. There are other complications, such as Prince Philip's visit, a scientific congress, celebrations of the 10th Anniversary of the Indian Republic, *and* a delayed aircraft—all making hotel accommodation in Delhi difficult. So the skipper decides to divert to Karachi. A descent through freezing level with the dazzling starboard de-icing light on (needs explaining to passengers?).

Karachi - Delhi. An I.A.F. Republic Day flypast rehearsal by Hunters and Canberras delays our letdown by 30 min. A moment after our disembarkation Prince Philip arrives from Agra by Queen's Flight Heron, followed by Mr. Nehru's Il-14 carrying the Prince's equerry and other members of the party.

Delhi - Calcutta. A short, 712 n.m. hop, with barely a few minutes at 38,000ft. Nevertheless, fuel consumed is 5,500 kg, representing a fuel consumption for the whole 1½ hr leg of 3,400 kg/hr—the best yet.

Calcutta - Rangoon. After a delay caused by short-circuiting of a time-switch, which had been affected by galley-spillage, we set course for Rangoon. On our arrival there after dark it is hot (82 deg F) and humid (85 per cent), like a shuttered English greenhouse in midsummer, compared with our air-conditioned Comet. The subsequent take-off in all the heat and humidity does not seem believable: within half a minute of unsticking, having used but half the 8,100ft runway, we are looking down from 1,000ft on the Irrawaddy, the moonlight glinting in its curves.

Rangoon - Bangkok. Another short hop of 321 n.m., accomplished in 50 minutes. The Bangkok terminal, new and pleasantly cool, is the scene of a two-hour wait while the weather at Hong Kong—the next port of call—clears: visibility there is down to 1,700 yd, 300 yd below limits.

Bangkok - overhead Hong Kong - Manila. Over Hong Kong is spread a carpet of cloud. Racecourse-tracking at 7,000ft, waiting for the rising sun to lift the carpet, we can see the twin peaks of Hong Kong Island jutting through the cloud. After 40 minutes we can wait no longer; the noisy blow-valves flip shut, climb power comes on, flaps move up, and we climb on course to the first flight-planned alternate—Tainan, Formosa. But 15 minutes later Tainan, too, give us below-limits weather, and we steer a new course to Manila, our second alternate. There, in perfect weather (and having given the Qantas ground staff only 40 minutes' notice), we touch down with 8,000 kg of fuel—sufficient for holding at 20,000ft for more than two hours, and representing one-third of the total fuel uplifted at Bangkok. Two very sharp turns while taxying in, one off the runway (where the captain politely pauses to avoid jet-blasting a taxying Piper Cub) and the other on to the apron, provide a remarkable illustration of the Comet's ground manœuvrability. There are no roars of power or lurches of brake —as smooth a mooring as might have been made by a daintily handled sailing dinghy.

Manila - Hong Kong. Our take-off from the 7,500ft Manila runway, of which we use half, and the subsequent climb-away over Manila Bay, must be providing an unprecedented spectacle for the Filipinos. The new Hong Kong runway is prominently visible even from 30,000ft on the descent: visibility is now, later in the day, unlimited. A long low approach—simpler now with the new runway, but still providing the passenger with dramatically intimate close-ups of Britain's bustling China-coast colony—ends with a perfect flare-out, round-out and touchdown. One more circuit and landing is made by another of the trainee captains.

Hong Kong - Tokyo (January 30). During breakfast, three-quarters of an hour en route, as depicted in *Flight* last week, we are intercepted by a Sabre of the Chinese Nationalist Air Force. An off-duty crew-member goes up front to inform the captain, who is unaware of the fact that the jet is in close formation a few feet from our wingtip. The Chinese pilot, his curiosity sated after five minutes (and his number, 24517, recorded by the Comet's crew) peels off back towards Formosa, joining another Sabre which has meanwhile kept a respectful—not to mention more prudent—distance.

Whilst at Tokyo the Comet departs on a training mission to Misawa, the Comet's alternate for Tokyo in northern Japan, and a U.S.A.F. base. A couple of F-100s are putting on a lively reheat take-off show, and it seems that the Comet's take-off, too, is even more impressive than usual today. The British jet climbs to 41,000ft in 21 minutes—"not bad for a 70-seat civil jet airliner," as a senior engineering officer later remarks.

Tokyo - London, via Hong Kong, Singapore, Colombo, Bombay, Bahrain, Beirut, Rome, Frankfurt. The return to London is a smoothly routine affair, with two particular highlights: a landing at Tainan, Formosa, and a visit to Kuala Lumpur. "No cameras" is the decree on landing at Tainan, where perhaps the biggest base of the Chinese Nationalist Air Force is situated. There is much here to interest the journalist from England, but its publication could possibly prejudice foreign airlines' rights to use the place as an alternate. Tainan is, however, also the main base of C.A.T. (Civil Air Transport)—the flag carrier of Nationalist China—about which some notes appear on another page.

At Kuala Lumpur, capital city of Malaya, it seems that the whole British community, not to mention thousands of Malays, turn out on a Sunday morning to greet the Comet 4. As an English planter says to a Comet captain: "When I look at the Comet 4 I no longer think I am far from home."

The touchdown at Hong Kong, on the fine new 8,300ft peninsular runway in Kowloon bay. Across the harbour lies Hong Kong Island

Missiles and Spaceflight

First authentic photograph of the Armstrong Whitworth Seaslug

SHELL FOR THE SEASLUG

AS the photograph above indicates, the subtitle to *Flight's* description of the Armstrong Whitworth Seaslug ship-to-air missile on November 21 last—"The most missile in the least space"—is particularly appropriate. Shipboard stowage demands an extremely compact weapon package, and compactness has been carried to the extreme of "chopping off" the front of the boost motors (and so dispensing with nose cones) roughly level with the nose of the missile. This photograph is the first to be released showing the true configuration of the missile, as it was displayed recently to NATO military leaders at SHAPE. All previous photographs, models and publicly displayed full-size versions of the Seaslug have been falsified by the addition of nose shapes.

Storage of the complete Seaslug missile is in itself a complex problem, and the diagram below shows the lightweight container which was developed to M.o.S. and Service requirements for this purpose. It is of the cheese-dish type with a deep, lightly stressed lid covering the missile, which is carried in a cradle spring-mounted from the rigid base.

The Seaslug is supported by its fore-and-aft launching feet and is carried in a sub-frame which is sprung vertically at each corner. Axial shocks are taken through spring packs built into the sub-frame and acting upon three of the missile rear feet. The weapon is located axially on the bottom rear foot and manufacturing tolerances in the positions of the side feet are accommodated by automatically adjusting wedges which clamp the ends of the side feet. The missile is held down by locks over the front and lower rear feet.

Shock reduction is obtained through ring spring packs. With these it is possible to obtain a very high spring rate, and the inherent damping (which is achieved by friction between the cone faces) absorbs a large amount of energy instead of storing it to cause rebound as with conventional springing. In order to reduce shock-loads during end-impact the cradle is restrained axially at the rear by two tie-rods connected to the base, and these rods are attached to a transverse torsion-bar mounted in bearings in the cradle. The two tie-rods are designed to load the torsion-bar in opposite directions when end loading is applied to the cradle.

Lateral location of the cradle is by rigid arms on either side of the base which carry rollers at their ends, the cradle fitting between the arms with the rollers bearing on rubber plates mounted on the cradle sides. All connections between cradle and base are through spherical bearings and each is designed to apply restraint in one direction only.

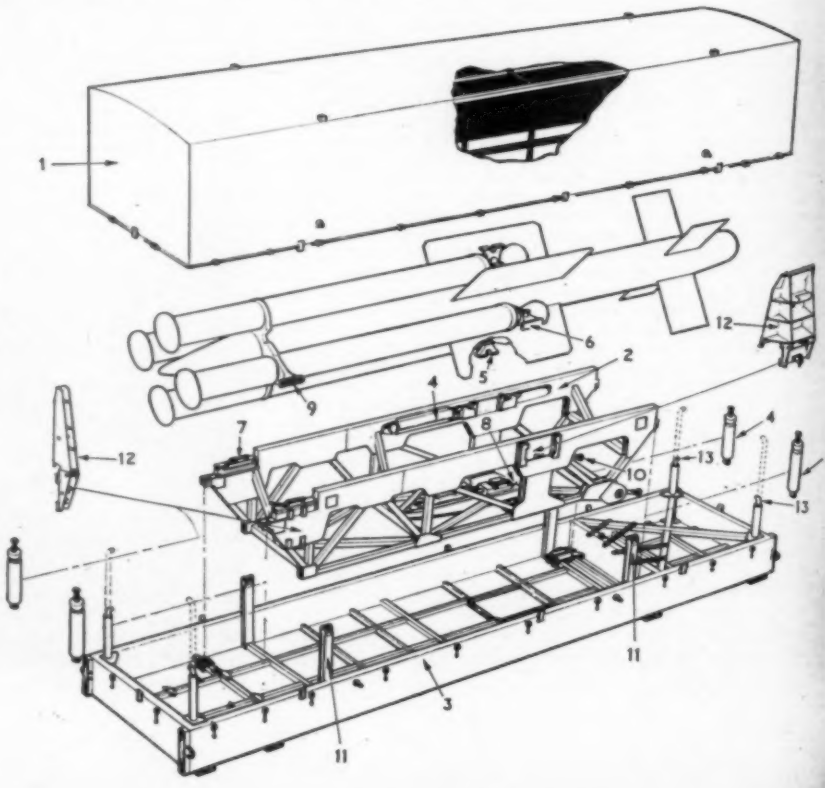
The torsion-bar system has several advantages. Apart from reducing the shock load on the cradle, it ensures that end-loads are taken equally on either side of the cradle, compensates for manufacturing tolerances so that the tie-rods do not have to be accurately adjusted, and provides axial location for the cradle—but allows it to take up any position dictated by the vertical spring packs and side restraint.

The cradle is constructed of bolted and riveted light-alloy tube and plate, while the base is made entirely from steel and has a rectangular steel-tube frame skinned inside and out to form a deep box section, the whole being welded except for the inner skins which are riveted to allow painting of the enclosed parts. The lid is made from 22 s.w.g. steel sheet with a tubular base and light angle stiffeners to which the skin is spot-welded.

Detachable guides which are stowed in the base are fitted to the cradle when installing a missile, and telescopic tubes are fitted in the corners of the base to guide the lid and prevent it striking the missile during fitting.

Development testing has included a drop from twelve inches at either end on to concrete; end-on impact at 3.5 m.p.h.; racking twelve inches at one corner when loaded, both with and without the lid; stacking two containers high and a thorough water spray test. All tests, the company state, have been satisfactorily completed, and acceptably low accelerations were recorded on the cargo during the impact tests.

As we described on November 21, the Seaslug is now coming into production as the primary armament of the four special guided missile ships of the new County Class. Firing trials from shore bases and the trials ship *Girdle Ness* continue to be most satisfactory. On page 215 news is given of the Short Seacat, the Royal Navy's short-range anti-aircraft missile.



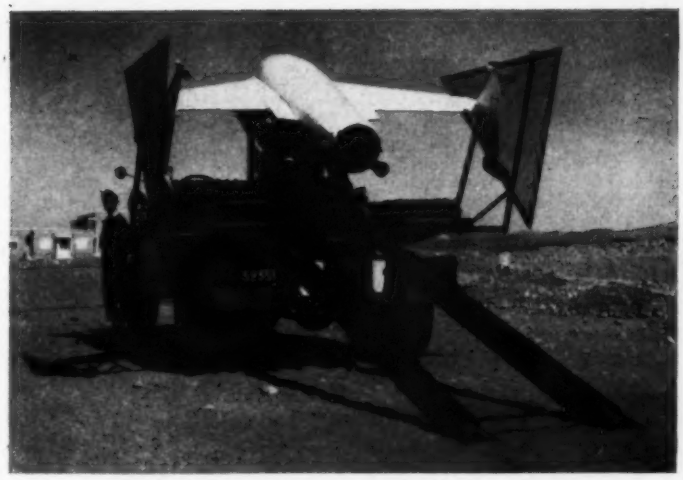
The lightweight container designed and produced to carry the Seaslug missile is of "cheese-dish" type. As indicated, the missile itself is supported in a sprung sub-frame

1, lightly stressed lid; 2, missile cradle; 3, rigid base; 4, axial spring packs; 5, bottom rear foot; 6, lower rear feet; 7, feet locks; 8, axial location for 5; 9, front foot; 10, cradle/base tie-rods; 11, locating arms; 12, detachable guides; 13, telescopic guide tubes

Missiles and Spaceflight . . .

SAHARA TEST CENTRE

By CHARLES DUCARRE

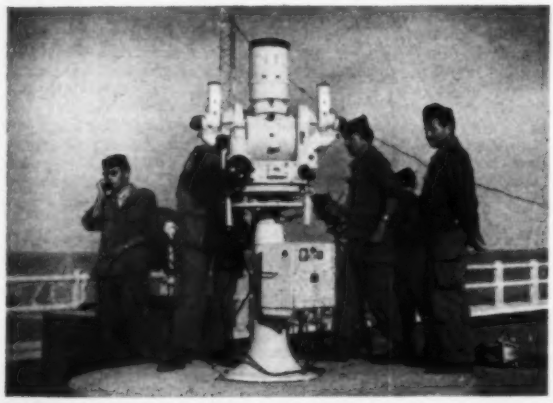


An SE.4200 ramjet-propelled bombardment missile on its launching lorry

THE Centre Interarmées d'Essais d'Engins Speciaux (Inter-service Test Centre for Special Weapons), CIESS in short, was officially inaugurated on April 24, 1947. Also known as the "Centre of Guir," it serves equally the French Air Force, the Army and the Navy. The Centre includes a long firing range, claimed to afford complete safety in all directions; a developed organization with important technical, industrial and aeronautical facilities; and an unspecified number of mobile bases. The location is the desert area of Colomb-Béchar, which includes the Colomb-Béchar township and the Kenadza coal mines. There are fair communications.

The ever-growing number of weapons to be launched has forced the Centre to increase the number of launching sites. To the first sites, at or near Colomb-Béchar itself, there was soon added a facility at Hammaguir, about 60 miles south-west of the township. The new area is now undergoing full development and several launching sites have been completed.

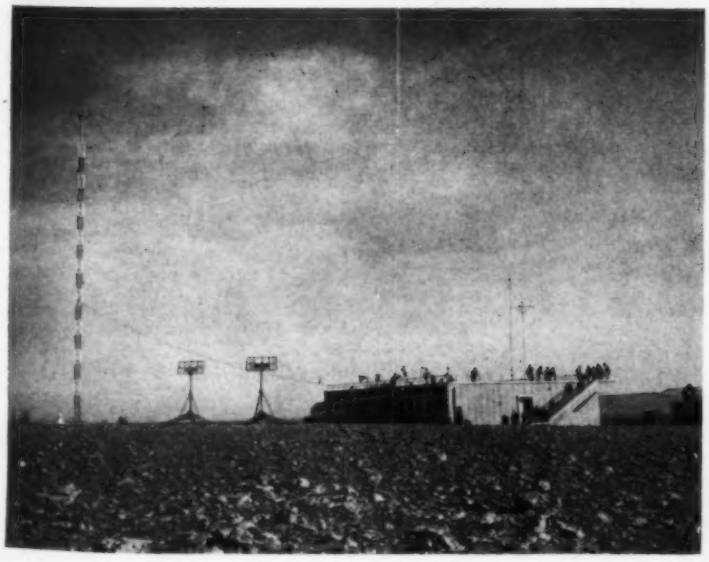
CIESS facilities include launching towers and ramps; shelters for personnel; location and observation facilities, including cine-theodolites, radar and cameras; scrutinizing facilities for trajectories; recovery facilities for weapons; a transport organization, including an air fleet for reconnaissance and transport; an extensive wire and radio communications network; electrical power plants and hydraulic installations; several workshops, with machine tools and the equipment necessary for constructors to work on prototype weapons; dust-removing installations; air-conditioning and filtering; hangars; a large road network; and an air base having a field length of 7,550ft.

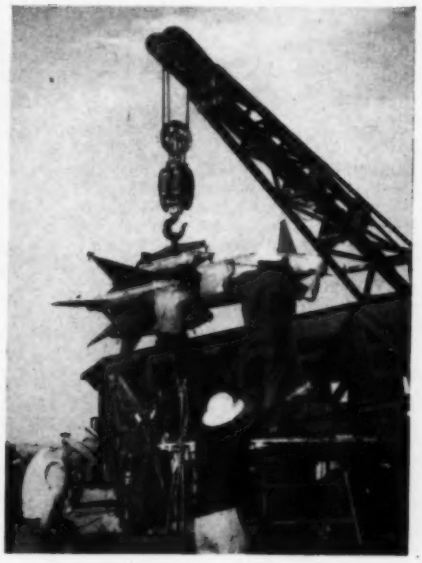


February is the most favourable month: then the region is subject to real fireworks. It is possible to launch several projectiles simultaneously from Colomb-Béchar and Hammaguir. Ordinarily, except in February, technicians need about three months to prepare a one-week firing programme. Firings are possible obliquely up to 31 miles from Colomb-Béchar; up to 620 miles toward Tindouf, from Hammaguir; up to 1,900 miles toward the south-west, in the direction of Bidon V and the Chad, from Hammaguir. Vertical firings are conducted at Bou Hamma, as well as ground-to-ground firings.

Apart from the military tests, under the jurisdiction of the Ministry of National Defence, the Centre is used also for a large number of purely scientific trials, such as observations on artificially created rain and the study of the higher atmospheric strata.

Left: A ciné-theodolite which permits automatic tracking of missiles. Below, left: Base II B1, in the vicinity of the CIESS (Joint Testing Centre for Special Weapons). This range has launching facilities for CT-10 and CT-20 target missiles. Below, right: a Parca (projectile auto radio propulsé contre avions) missile on its mobile launching ramp





Missiles and Spaceflight . . .

PROGRESS IN ROCKETRY

INTERNATIONALLY known and respected as president of the International Astronautical Federation, the U.S. lawyer Andrew G. Haley has devoted his attention over many years to the field of rocketry. He has now written what is clearly intended as his definitive essay on the field in general, and this impressive volume* was published last month.

The book includes chapters which outline the early history of rocketry in a manner which surpasses anything attempted hitherto. In particular, the sections dealing with the early growth of the American rocket and missile industry are of such value as to constitute a great service for posterity.

In his broader histories of the international scene, Mr. Haley is slightly less sound, and, although he tries to be scrupulously fair, one could argue that he fails to give proper prominence to the weapons of Congreve and Le Prieur.

From early history Mr. Haley turns to consideration of how rockets work. In a single paragraph we find both "This exhaust stream is often called a jet, and properly so," and "a rocket can operate where there is no atmosphere; a jet cannot." Later in the same chapter is this explanation of the jet-deflection system pioneered by the V-2: "A stabilization system, external to the powerplant proper, adjusts the position of heavy graphite vanes placed in the exhaust. This deflects the exhaust and moves the centre of thrust in the forward end of the thrust chamber to some desired point off the longitudinal axis of the missile, which steers the missile, to a certain extent." And later, when the author starts to describe actual hardware, one's confidence becomes progressively more and more sapped.

The worst feature of all is that Mr. Haley appears not to be aware of the vast quantity of information which has been officially cleared for publication by his own government, and by those of other Western nations, during the past five years. Throughout, he approaches the subject in the frame of mind which assumes that nothing is officially known about current work; thus we get the following remarkable statements. Atlas is stated to have "inertial guidance . . . supplied by the Bosch Arms (sic) Company." Titan is "designed to be a successor to the Atlas," is said to have a second-stage engine "made by the Reaction Motors Corporation (sic)" and "initial flight tests have begun at the Cape Canaveral missile test center." (As this review is written Titan has yet to get off the pad.)

Bomarc is said to have "two of the Aerojet-General Corporation's liquid rocket engines" and to be "produced at the Boeing Airplane Company's Wichita, Kansas, facility." Nike Hercules is said to have "a three-motor first-stage booster" while Rascal has apparently "undergone successful flight-testing, demonstrating pinpoint accuracy at up to a 300-mile target range." In a single event-packed flight, the Bell X-2 is said to have "exceeded 2,200 miles per hour and gained 127,000ft of altitude before going out of control on its first flight test. It crashed due to a turn made at too great a speed. . . ."

Of Britain, Mr. Haley says "a Royal Aircraft Establishment . . . advises the Royal Air Force (no mention is made of the Ministry of Supply anywhere in this chapter). . . . Rocket propulsion development is carried on at Wescott (sic). . . . Other ranges are being completed at North Coates. . . . Britain . . . has started work on a 2,500-mile-range ballistic missile known as the Black Knight." After extensive dissertations upon such rudimentary vehicles as the Lop-Gap and Stooge, Mr. Haley says "the Thunderbird . . . is a radar beam rider . . . variously reported as using both a solid and a liquid propellant rocket . . ."; and of Seaslug "designed by the Navy, it is being manufactured by Armstrong Whitworth." Avro's Blue Steel is merely hinted at as a rumour.

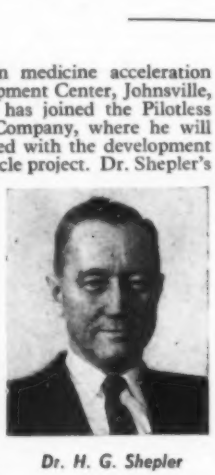
The author goes on to describe the Snarler "tested in 1950 in a Hawker P.1702 (sic)" and devotes a major paragraph to the long-defunct Sprite—but completely fails to say anything tangible about the Screamer, Super Sprite or Spectre. The Screamer and Spectre were the first completely controllable, variable-thrust rocket engines in the world; this journal devoted five pages to the former as long ago as July 27, 1956, but Mr. Haley does not appear to have heard of it. He is similarly unconvincing when he turns to France and Canada—he tells us Velvet Glove is in production at Cold Lake—and his illustration of an RTV-2 he describes as a "British ramjet missile."

It is in fact tragic that so potentially valuable a work should be marred by such weakness—and by such poor sub-editing that one reads of the "Junker Airplane Company," "Rheinmetall-Borsing" (twice), the German Institute for "Segelfug," the "U.S.S. Babero," "Captain Charles E. Yaeger" (three times), the French "Espadron" and the Trident "built by Ovest Aviation" (twice). It is to be hoped that the publishers, who are renowned for works which can be relied upon, will soon issue a revised edition. Only then will it be possible to give Mr. Haley's book the unreserved praise which half of it already merits. W. T. G.

*"*Rocketry and Space Exploration*," by Andrew G. Haley. D. Van Nostrand Company Ltd., 358 Kensington High Street, London, W.14. Price 51s. Illustrated.*

DYNA-SOAR PHYSIOLOGIST

Until recently director of the aviation medicine acceleration laboratory at the U.S. Naval Air Development Center, Johnsville, Pennsylvania, Dr. Herbert G. Shepler has joined the Pilotless Aircraft Division of Boeing Airplane Company, where he will direct the human factors group associated with the development of the Dyna-Soar piloted boost glide vehicle project. Dr. Shepler's most recent assignment prior to his retirement from the Service was the study of human factors in the North American X-15, including the development of a water capsule which would offer protection for the crews of future space vehicles.



Dr. H. G. Shepler

Competitive contracts for first-phase development of the Dyna-Soar are held by the Boeing and Martin companies. The Boeing team includes Aerojet-General, launching-base design development and boost rocket systems development; Chance Vought, pilot capsule and escape system development; General Electric, tracking and telemetering system management; Goodyear Aircraft, radio guidance system management; North American Aviation, automatic flight and landing system management and first-stage booster development; R.C.A., high-resolution radar development; and Ramo-Wooldridge, reconnaissance system management.

BIG BUSINESS

Space research allocation in the 1960 fiscal-year U.S. budget proposed last month by President Eisenhower amounts to no less than $485.3 million. Included in this National Aeronautics and Space Administration figure is $333.07 million for research and development, as detailed (col. 2), and the remaining money is for salaries and expenses ($94.43m) and construction and equipment ($57.8m).

Corresponding appropriations for the 1959 fiscal year are: research and development, $50m (plus $20.75m supplementary estimate); salaries and expenses, $83.1m (plus $3.354m); construction and equipment, $48m (plus $24.25m). In addition, transfers totalling $154,619,532 have been made, or are being made, to NASA from the Department of Defense (Air Force, Advanced Research Projects Agency, Navy and Army projects).

The NASA research and development total is divided into seven main programmes, estimates for which are listed below.

	1959 $ million	1960 $ million
Aircraft, missile and spacecraft research (support of NASA plant, JPL plant, and research contracts)	13.995	33.026
Scientific investigations in space (sounding rockets, Earth satellites, lunar and deep-space probes, Vanguard programme)	110.563	118.344
Satellite applications investigations (meteorology, communications)	8.10	28.0
Space operations technology (manned spaceflight, space-rendezvous techniques)	37.661	73.0
Space-propulsion technology (solid-fuel rockets, high energy fuel rockets, million-pound single-chamber engine, nuclear rocket-engines, space engines, auxiliary power units)	29.0	64.2
Space systems technology (advanced vehicle systems, booster recovery systems, orbiting space laboratories)	1.0	5.0
Supporting activities (tracking and data acquisition)	4.3	11.5
Totals	204.619	333.07

Missiles and Spaceflight . . .

COMMONWEALTH SPACE MEETING

Church House, Westminster, will be the scene of two astronautical meetings in August and September this year. In addition to the 10th International Astronautical Federation Congress (August 31-September 5), a Commonwealth Spaceflight Symposium will be held there during the preceding week (on August 27-28). The Commonwealth meeting is being arranged by the British Interplanetary Society, who are inviting senior government and industry representatives with the object of "encouraging Commonwealth initiative in the field of space research."

RESULTS FROM RUSSIA

Sixteen preliminary Russian reports on rocket and satellite investigations have been received by the Royal Society. This was stated in reply to a question by Mr. Gresham Cooke in the House of Commons on February 3 by Mr. H. Nicholls, Parliamentary Secretary to the Ministry of Works. The IGY scheme, Mr. Nicholls said, only involved publication of full scientific reports in generally available literature within one year from the end of each experiment. No results obtained from the recent Soviet space rocket had yet been received, but preliminary results might be obtained by the end of February.

SPACE IN THE LECTURE-HALL

Before the Royal Aeronautical Society in London last night (February 12) Mr. W. H. Stephens was due to lecture on *Earth Satellites*. Head of the Guided Weapons Department of R.A.E. Farnborough from 1954 until last month, Mr. Stephens is now Director-general, Ballistic Missiles at the Ministry of Supply.

Satellites and spaceflight will also be included in the programme of the special Montreal meeting organized by the Canadian Aeronautical Institute on February 23-24 to commemorate the 50th anniversary of powered flight in Canada. Space research by the U.S.A. will be reviewed by Dr. H. L. Dryden of NASA, and Canadian lecturers on the subject in general will include G. D. Watson of the Defence Research Board and Dr. P. M. Millman of the National Research Council.

SOVIET SUGGESTION

A Moscow Radio broadcast on February 27 suggested that national resources should be pooled to send an international expedition of "several dozen" spacecraft into outer space. Although this would be extremely expensive, "if the whole world co-operated, not only in the scientific work but in bearing the cost, that would be a big help." The broadcast added, "We can be sure that the difficulties connected with the mastery of outer space will be overcome much better and sooner if several countries—and especially the Soviet Union and the United States—pool their material and intellectual resources."

ADVANCED PROJECTS

The U.S.A. hopes to test a rocket next year that will be ten times as powerful as any yet produced, according to Mr. Roy Johnson, director of the Advanced Research Projects Agency of the U.S. Department of Defense. The Army, he explained in a paper before the New York Bar Association, was devising a booster with 1.5 million pounds of thrust by grouping together a number of existing rocket engines. Using an Atlas as a second stage and a third stage using high-energy fuel, the new boost rocket not only would be able to put a 25,000 lb space station in orbit, but could send a manned vehicle around the Moon.

Mr. Johnson went on to outline the following Defense Department projects: (1) Project Midas, designed to use satellites in an early-warning system against surprise missile attack; (2) the use of 2,500 lb satellites in "stationary" orbits 22,000 miles above the Earth for global communications, and (3) devising means to manœuvre a space vehicle rather than merely following a pre-set trajectory.

For the next two years, Mr. Johnson said, the U.S. space programme would be based largely on the use of four military rockets—Thor, Jupiter, Atlas and Titan. The first two of these could launch 2,000 lb satellites into low orbit, while Atlas and Titan could launch satellites weighing 4,000 lb. With a high-energy upper stage now being developed, Atlas would be able to launch useful satellite payloads of up to five tons, to land 1,000 lb of instruments on the Moon or to land several hundred pounds on Venus or Mars.

ROCKET PIONEER HONOURED

The first annual Louis W. Hill Space Transportation Award has been made posthumously to Dr. Robert H. Goddard (1882-1945), the U.S. rocket pioneer, and was presented to his widow by S. Paul Johnston, director of the Institute of the Aeronautical Sciences, on January 27. Established by the Hill family foundation of Minneapolis to honour U.S. scientists for "research in any or all of the fundamental sciences relating to space travel or space technology," it is administered by the I.A.S.

Dr. Goddard began his rocket researches in 1899 when only 17, and many of the techniques which he first developed and tried out are now regarded as basic. He first suggested the multi-stage rocket in 1909. Other modern devices which resulted directly from his work are the U.S. Army "bazooka" launcher and jet-assisted take-off.

SEACAT AND TIGERCAT

On February 4 the Admiralty announced that the close-range ship-to-air missile under development by Short Brothers and Harland Ltd. (as a replacement for the 40-mm gun of the Royal Navy) is to be named the Seacat. The manufacturers state that the weapon will deal, with a high degree of effectiveness, with aircraft which may evade defensive fighters and long-range guided weapons. Seacat is a small and highly manœuvrable weapon powered by a solid-propellant motor. It is designed to be "instantly ready to attack" and is suitable for installation aboard relatively small ships.

Progenitor of the Seacat was the SX-A5 test vehicle, which was employed for preliminary research. Seacat itself may be expected to differ appreciably from the SX-A5 although its configuration, control and guidance remain closely guarded. Short Brothers and Harland are intensively developing Seacat under contract from the Ministry of Supply, and a considerable number of ships may be equipped with the weapon "by the early 1960s." The company are also investigating a land-based variant, to which they have given the name Tigercat, for use in surface-to-air and surface-to-surface rôles.

MACE FOR U.S.A.F. EUROPE

It was announced on Monday last that "early this spring" the Martin TM-76A Mace will replace the TM-61A and TM-61C as the weapon of the 587 Tactical Missile Group. This unit forms part of the U.S. Air Force Europe and is based at Sembach, Western Germany. Mace is a development of the Matador; it differs chiefly in having improved guidance (Goodyear ATRAN map-comparison system), greater tankage, improved ability to strike at all altitudes in all weathers, and in being designed to the weapon-system approach (the Martin Company, Baltimore Division, being co-ordinator for the whole system, including launcher, prime mover, test equipment and ground-handling gear). Powerplant is an Allison J33 turbojet.

TITAN FLIES

After two unsuccessful attempts, on December 20 and February 3, the U.S. Air Force XSM-68 Titan ICBM finally got off the ground at Cape Canaveral on February 6 (see photograph on right). Prime contractor for the WS-107-A-2 weapon system, of which Titan is a part, is the Denver Division of the Martin Company.

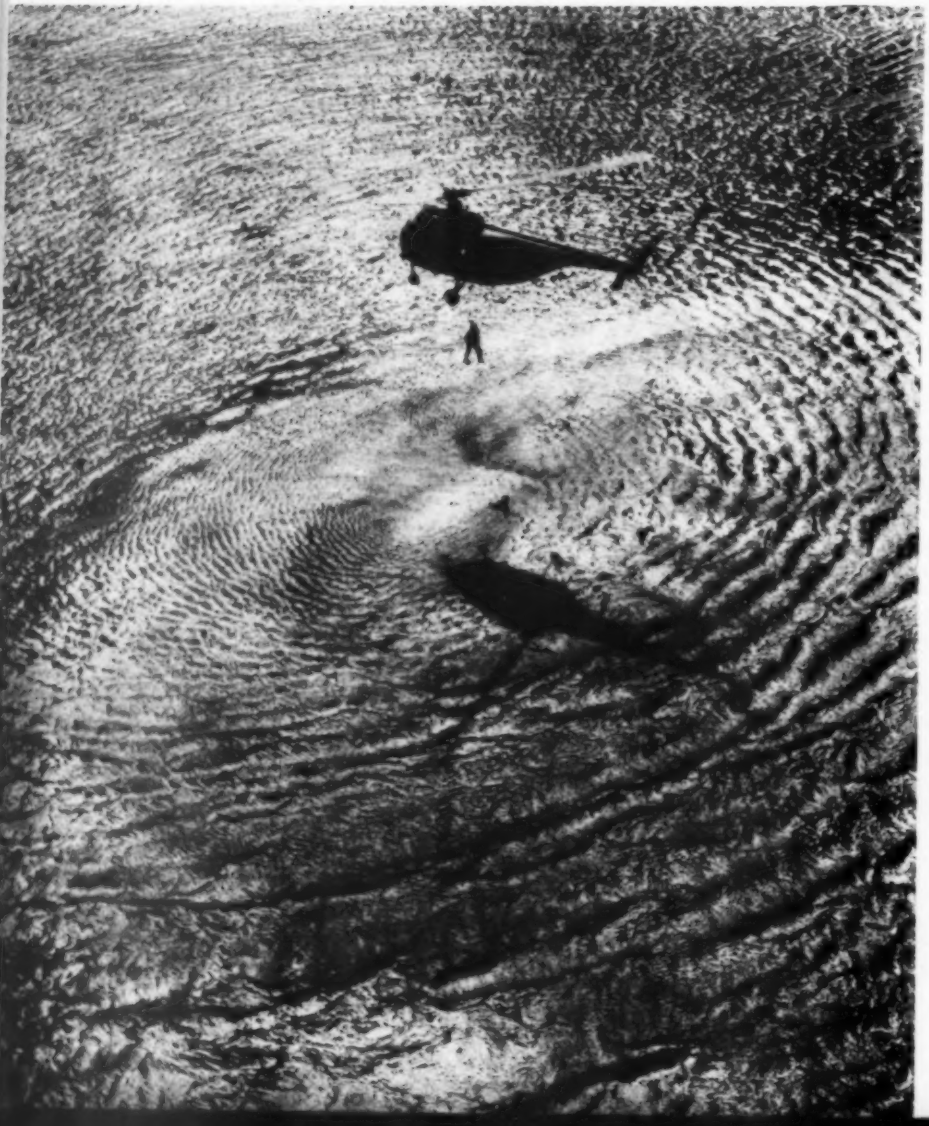
Titan is a missile of more advanced design than Convair's SM-65 Atlas; it is designed to supplement rather than replace the Atlas, and its development is running approximately one year behind that of its rival. Chief features of Titan are: choice of a true two-stage configuration, separation and ignition of the second stage occurring beyond the atmosphere; an airframe of high fineness ratio constructed from planks of stretch-formed and chemically-milled high-strength light alloy; liquid oxygen/RP-1 propulsion by Aerojet-General, the first-stage engine having two gimbal-mounted chambers each of 150,000 lb thrust and the second stage having a single gimbal-mounted chamber of 60,000 lb thrust; pure-inertial guidance of very advanced design by Bosch Arma; and a nose-cone by Avco. On its first flight only the first stage was operative, the second-stage tankage being filled with water to produce the correct weight and moment of inertia. The missile left the pad cleanly—a tribute to the sophisticated launching system mentioned in our December 5 issue—and travelled a distance of between 200 and 450 miles.

First successful Titan launch, Cape Canaveral, February 6 (see report above)

The photographic quality of this picture of Shackleton MR.3 was sufficient to give No. 201 Squadron second place in the air-to-air section. Pilot: F/L. Pretty. Camera operator: Cpl. Hawkins

Entered in the "action" class by St. Mawgan, the superb picture of a Whirlwind below was the only entry in either competition to which the judges awarded full marks. Camera operator: Cpl. Hawkins

COASTAL COMMAND CAPTURES . . .

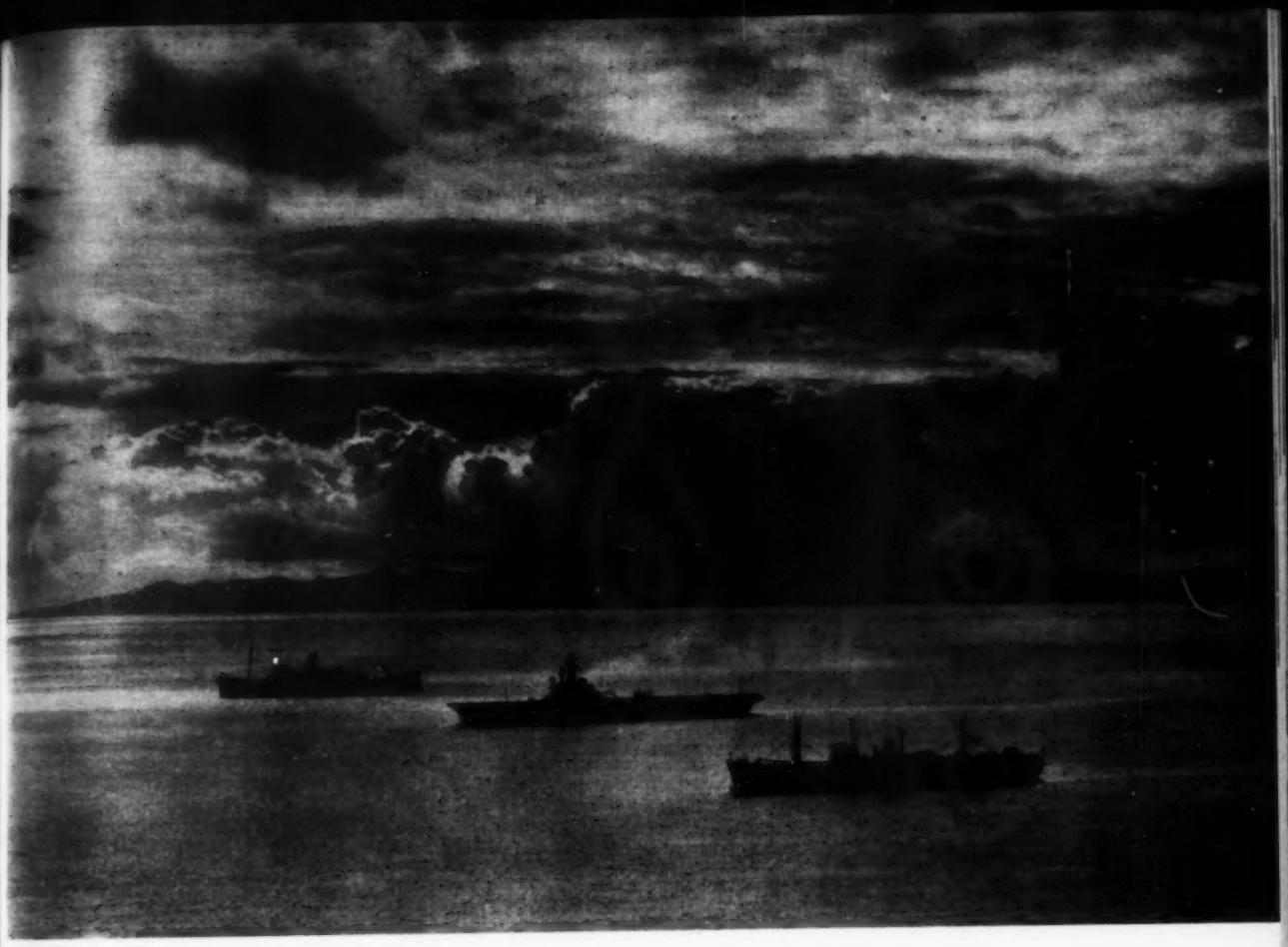


THE quartet of camera studies reproduced here is a selection from the inter-squadron and inter-station photographic competitions held again this year by R.A.F. Coastal Command.

For the four classes of the squadron contest each of the ten competing units had to submit examples of air-to-air, air-to-ground, air-to-sea (merchant vessel) and air-to-sea (service vessel) pictorial work. The standard was a good deal higher than in previous years, competitors having devoted much more careful thought to lighting and originality; but in actual "finish" there was still room for improvement. No. 224 Squadron, North Front, Gibraltar, were placed first with 82 marks, followed closely by No. 120 (Aldergrove) who scored 80; third, with 68, was No. 206 of St. Mawgan.

Seven units competed in the inter-station competition, which was devised to test the general ability of the photographic sections. Prints of eight classes of ground subjects had to be submitted. There was one exception among the choice of subject, St. Mawgan entering in the "action" class the splendid helicopter picture seen on this page.

Most entries were above average and marking was high. Even so, it was a runaway win for St. Mawgan with a total of 175 marks. Runners-up were H.Q. Unit, Coastal Command, 133, followed by Ballykelly, 126. Invited by S/L. G. N. Perella, Command Photographic Officer, to judge the competitions were R. F. Alderton and P. Ward of the Kodak Company and John Yoxall of *Flight*.



. . . THE GRANDEUR OF SKY, SUN AND SEA

A tremendous breadth of sea and sky is contained in the picture above, which No. 224 Squadron call "Fleet Train." Pilot: F/L. Hinton. Camera operator: Sgt. Easiener

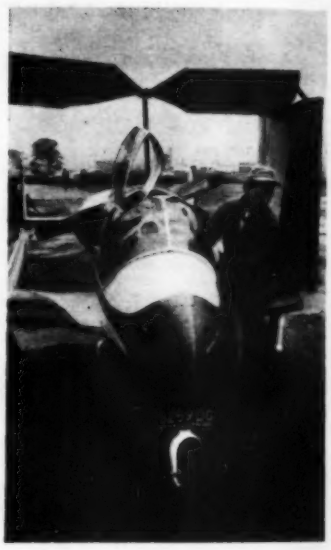
This fine impression of Cape St. Vincent, Portugal, must surely be one of the lowest air-to-ground views ever taken. No. 224 Squadron. Pilot: F/O. Kmiecik. Camera operator: Sgt. Howells

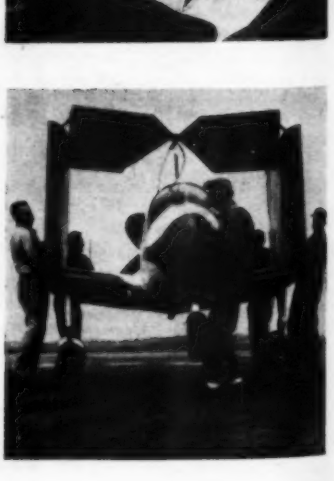
LELAND BRYAN'S AUTOPLANE

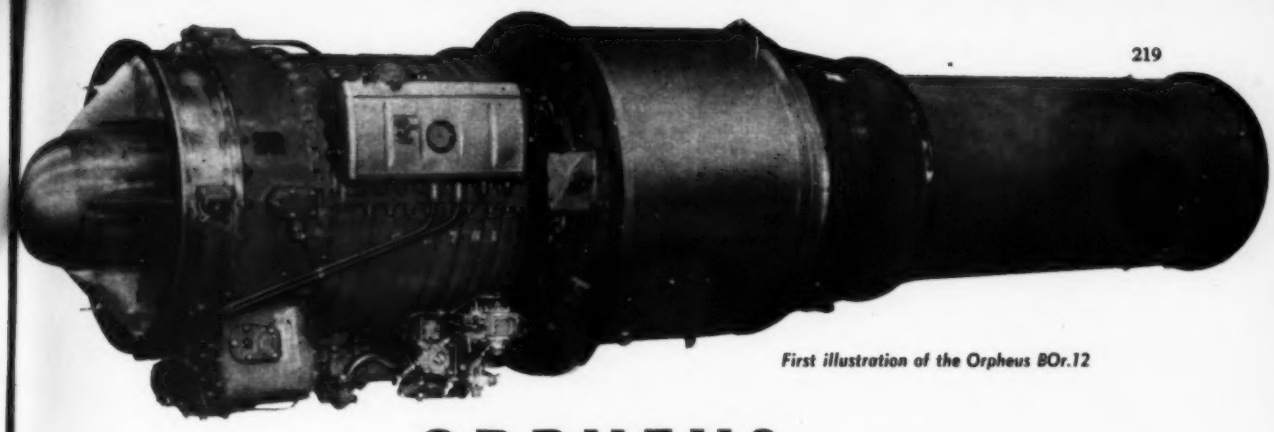
ONE of the several types of roadable aircraft in existence in the U.S.A., the Autoplane or "hop rod" illustrated on this page was built by Leland Bryan of Highland, Michigan, from the basic structure of a standard Ercoupe. Unlike Molt Taylor's Aerocar (*Flight*, January 17, 1958), Bryan's twin-boom machine uses its pusher propeller for power on the road as well as during flight—no power transmission to the wheels is provided.

This is the second machine of this type to be built by Bryan, and is to be followed by an improved third version. Powered by a 75 h.p. Continental engine, the current machine cruises at 85 m.p.h. in the air and about 50 m.p.h. on the road, with maximum speeds of 105 and 60 m.p.h. respectively. Other data include span, 22ft 6in, (folded) 8ft; length, 17ft 6in; wing area, 105 sq ft and empty weight, 720 lb.

Various aspects of driving, flying and converting the machine are apparent in the photographs. The man seen pulling, lifting (at the nose), wing-folding and prop-swinging is the constructor, whose regular occupation is that of General Motors mechanic.







First illustration of the Orpheus BOr.12

ORPHEUS

A VERSATILE AND LIGHTWEIGHT TURBOJET

POLITICALLY the history of the Orpheus turbojet is unique. Planned as a private venture, it has now become virtually a world standard in the 5,000 lb-thrust class, yet practically none of its development has been sponsored by the British Government. Few engines have developed as rapidly and achieved such universal success in such diverse applications as supersonic interceptors, basic trainers, transports, research aircraft and ground attack machines, and in the years to come the Orpheus is certain to prove itself even more versatile.

All design and development of the Orpheus has been handled by the great organization at Filton and Patchway which has successively been the Engine Division of the Bristol Aeroplane Company, Bristol Aero-Engines Ltd. and the "Bristol" portion of Bristol Siddeley Engines Ltd. After gaining experience with the B.E.17 pilotless-bomber engine, their first essay into the medium-thrust field evolved around the B.E.22 Saturn. During 1952, however, the Ministry of Supply requirement for this engine lapsed and its development was accordingly abandoned. This was a blow to Mr. W. E. W. Petter, managing director of Folland Aircraft, who had visualized the engine as the powerplant for his Gnat light fighter, then on the drawing boards. During 1953, therefore, Bristol's Engine Division and Folland Aircraft collaborated in the design of a private-venture engine originally known as the B.E.26 and later given the name Orpheus.

Like the Saturn, the Orpheus was planned as a single-spool axial unit of relatively low pressure-ratio. After choosing 4,850 lb as the design rating it was found possible to restrict the weight to an estimated figure of 850 lb, by employing only two bearings combined with novel structural principles and extreme simplicity in the overall design of the engine and its control and accessory systems.

During 1953 the Supreme Headquarters Allied Powers Europe instituted a specification for a lightweight fighter and ground attack aeroplane, to be designed, produced and operated as a standard type among the NATO air forces. Virtually all the design studies prepared by the interested companies were based upon the Bristol Orpheus, and as a result a substantial contribution towards the cost of the initial engine development was made available from the Mutual Weapons Development Programme.

During January 1954 the first drawings and manufacturing instructions were issued to the shops, and all detail drawings were cleared by the end of June. So rapid was the first-build that the complete engine was started and run on the bench on December 11, 1954 (probably the first time in history that a gas-turbine was designed and run in a single calendar year). To some extent the design was hastened by employing a compressor very similar to the low-pressure spool of the B.E.25 Orion turboprop.

By the end of 1954 Folland had completed a fair amount of flying with the Midge (geometrically similar to the Gnat but powered by an Armstrong Siddeley Viper), and the Orpheus was urgently needed to enable the true Gnat to take the air the following year. It was accordingly decided that, as an initial target, the Orpheus should be cleared for flight at the restricted rating of 3,285 lb. A declared type test at this rating was successfully completed in May 1955, and the engine first flew (as the powerplant of the Gnat) in July. Five Orpheus were running by April 27 of that year and during the first six months of bench-testing over 2,000 hr were run without a single major problem being encountered. It is particularly worth noting that these early engines weighed only 760 lb, some 90 lb under the original estimate. Even at the reduced 3,285-lb rating the thrust/weight ratio was better than that of any other type-tested engine in the world at that time.

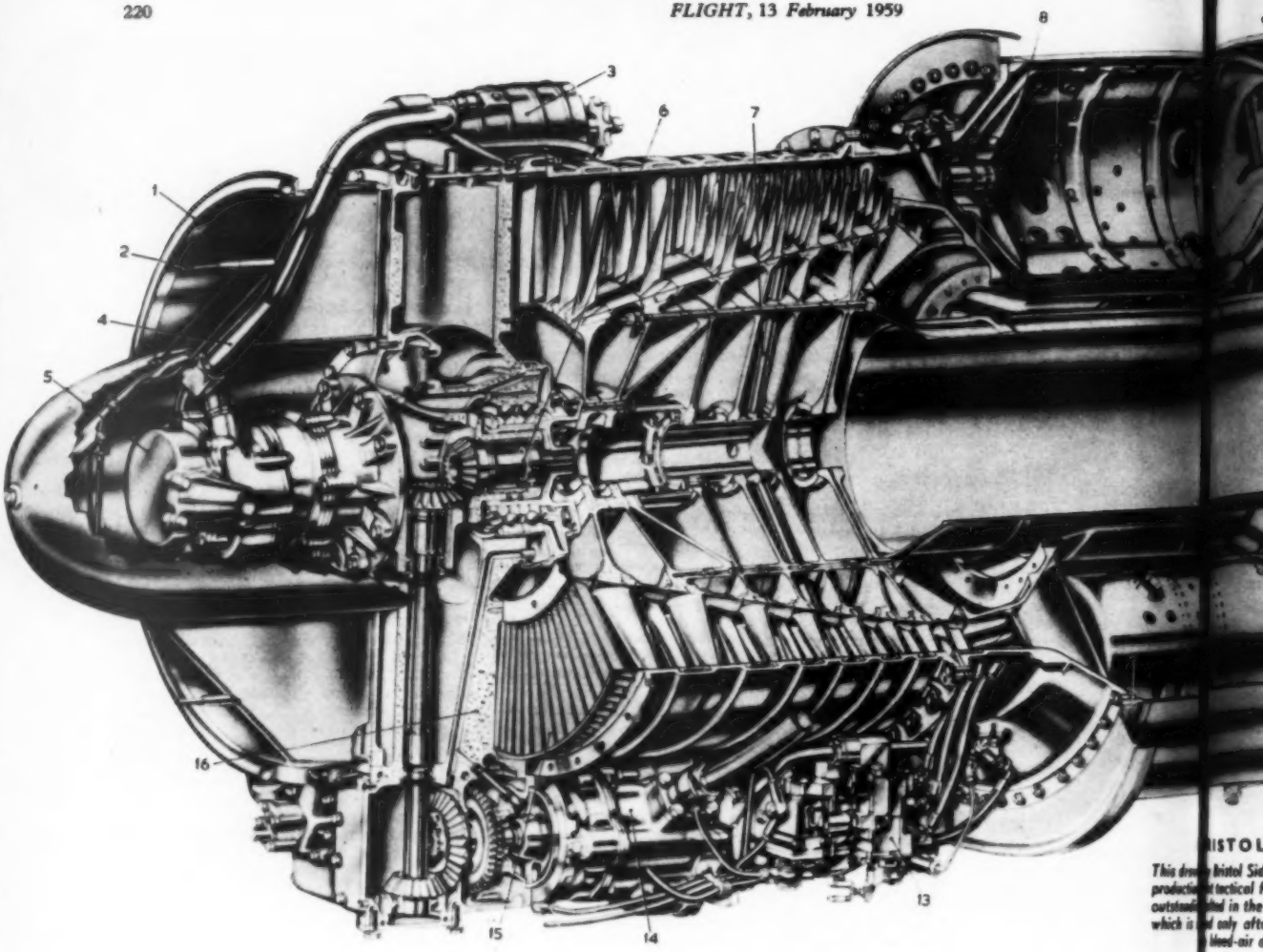
The original Orpheus carried the Ministry of Supply rating designation BOr.1, and by January 1956 it had successfully completed a declared type test at its design rating of 4,050 lb. As designed for the Gnat, the fuel-flow requirements could be met by a single B-size pump and the accessory gear casing was tailored accordingly. At heights above about 12,000ft it was possible to achieve fuel flows—and hence thrust—equal to the values required by the more powerful BOr.3, specified for the NATO strike aircraft. The BOr.3 however was designed to have a sea-level rating of 4,850 lb and was therefore fitted with the larger D-size pump. In order to gain experience at the higher thrust it was decided to fit twin B-size pumps on an Orpheus 1, the additional pump being mounted on the hydraulic-pump attachment face.

Throughout the early part of 1956 ground-running of these engines was accomplished at the full brochure rating of 4,850 lb and the engine for the Gnat, the BOr.2 with a rating of 4,520 lb, began its flight development in pods mounted under the wings of an Avro Ashton test bed. On August 9, 1956, the prototype Fiat G.91, the first of the NATO aircraft to take the air, flew for the first time on the reduced power of a BOr.1. The next milestone was the full type test of the BOr.2 in November 1956.

Three BOr.1s were delivered to Fiat during 1956 and additional engines were delivered to Dassault, whose Etendard VI flew in January 1957, and Bréguet, whose Type 1001 Taon first flew in August 1957. Differences between the BOr.1 and the production engines are slight. The most significant change was the introduction of a compressor incorporating blading which was redesigned to take

ORPHEUS-POWERED AIRCRAFT

	Category	Engine	Remarks
Aerfer Leone (Italy) ...	Intercepter	BOr.12	Supersonic
Avro Ashton (G.B.) ...	Test bed	Various	Orpheus pods under wing
Bréguet 1001 Taon (F.) ...	Tac. strike	801	BOr.12SR in later version
Bristol 205 (G.B.)	Transport	?	Four on rear fuselage
Canadair Sabre	Test bed	801/803	Used by Bristol Siddeley
Dassault Etendard VI (F.) ...	Tac. strike	801/803	
Fiat G.91/91A (Italy) ...	Tac. strike	801/803	
Fiat G.91R (Italy)	Recce.	803	
Fiat G.91S (Italy)	Tac. strike	BOr.12	Supersonic
Fiat G.91T (Italy)	Trainer	803	
Folland Gnat Mk 1 (G.B.) ...	Fighter/strike	701	First aircraft to fly with Orpheus
Folland Gnat Mk 2 (G.B.) ...	Fighter/strike	Reheat	Supersonic
Folland Gnat T.1 (G.B.) ...	Trainer	BOr.4	
Fuji TIF-2 (Japan)	Trainer	805	Production engine is BOr.4
Handley Page H.P 113 (G.B.)	Transport	?	Two engines
Hawker P.1127 (G.B.) ...	Tac. strike	?	Orpheus fan derivative?
Hindustan (India)	Fighter/trainer	BOr.12?	Two engines?
Hispano HA-300 (Spain) ...	Fighter/trainer	BOr.12?	Probably Mk 703 initially
Hunting H-107 (G.B.) ...	Transport	?	Two engines
Ikarus B-12 (Yugoslavia) ...	Fighter	701	
Lockheed Jetstar (U.S.A.) ...	Transport	TJ-37	Two engines; or four JT-12
N.A.A. Model 249 (U.S.A.)	Trainer	BOr.4	Alternative powerplant to J34
Short SB.5 (G.B.)	Research	802	
Sud Baroudeur (F.)	Tac. strike	BOr.12	Alternative to Atar



This dra... Bristol Sid... production ... tactical ... outstand... ...ed in the ... which is ... only afte... bleed-air ...

ORPHEUS . . .

advantage of improved techniques and, in particular, to avoid the aerodynamic overloading of the high-pressure end which slightly marred the performance of the BOr.1 compressor. In addition, the cooling-air supply to the turbine stators was slightly reduced, resulting in a useful reduction in specific fuel consumption. The difference between the BOr.2 (Mk 700 series) and BOr.3 (Mk 800 series) is of an even more minor nature. As already noted the NATO engine incorporates the larger fuel pump, and exists in several forms to suit the various installation requirements of the three NATO machines; and, owing to the diminutive size of the Gnat, the BOr.2 or Mk 701 has a slightly slimmer wheelcase and more compact accessories.

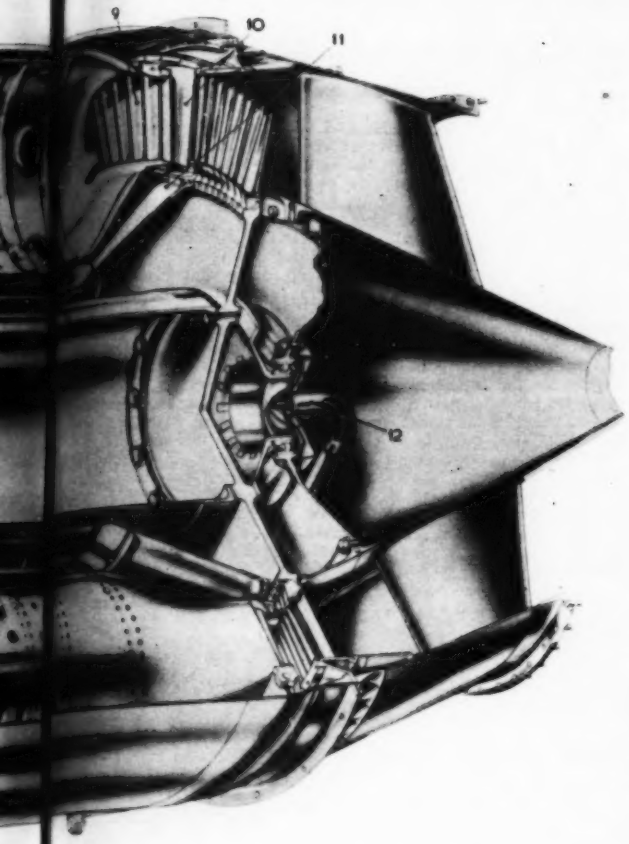
During 1957 the final development to the 4,850 lb type test took place on the various types of BOr.3 specified for the NATO programme. The programme was slightly delayed by the non-delivery of certain items—such as the Labinal D.C. generator and Messier hydraulic pump—which were designed in France for this powerplant, but the final type test was successfully completed in May 1957, more than a month ahead of schedule. The competing aircraft for the NATO strike order were evaluated in a series of technical trials at the C.E.V. Brétigny, near Paris, during September and October 1957. Present at these trials were the Fiat G.91, Dassault Etendard VI and Bréguet 1001 Taon, together with the Atar-powered Sud Baroudeur and Dassault Etendard IV.

ORPHEUS SUB-TYPES

Rating	Mk	Thrust (lb)	Weight (lb)	Length (in)	Type-test	Remarks
Initial	—	3,285	760	73.0	1955	
BOr.1	—	4,050	750	73.0	1956	
BOr.2	701	4,520	790	73.0	1956	For Gnat. Lucas GBB fuel pump
BOr.3	801	4,850	825	75.45	1957	D-size fuel pump
BOr.3	803	5,000	825	75.45	1958	Standard NATO engine
BOr.3/5	810	4,850	915	75.45	1957	All-weather, extra accessories, 5,100 lb in production version
BOr.4	100	4,230	890	75.5	—	All-weather, derated
BOr.11	—	5,760	985	79.27	—	
BOr.12	—	6,810	1,100	79.27	—	
BOr.12SR	—	8,000	1,100	82.7	—	Simple reheat (afterburner)
Fan	—	?	?	?	—	Orpheus derivative

Apart from the Baroudeur, these aircraft were all relatively untried prototypes, and it is therefore particularly commendable that serviceability was exceedingly high throughout. According to Bristol "the primary inspection [of the engine] was found to take less than 30 min . . . the intermediate inspection was found to take 1 hr . . . the minor inspection took approximately 4 hr. All these times may be expected to be reduced with increasing experience on the part of the maintenance personnel. . . . An engine in one of the aircraft taking part was changed in an elapsed time of 44 min." Throughout the three weeks of the trials each Orpheus-powered aircraft averaged more than two flights per day.

Winner of the contest was announced as the Fiat G.91; and, probably as a palliative to the French aircraft industry, it was stated that a developed version of the Taon would be produced with the BOr.12 engine (described later) for use as a "second-generation" machine from 1961 onwards. Current orders for the G.91 appear to total at least 100 aircraft; 25 development aircraft have been built, batches of 50 are believed to have been ordered by Italy and Germany, and the United States have stated their willingness to duplicate NATO orders in order to provide aircraft for such countries as Greece and Turkey. In order to provide a continental source of engines, Fiat SpA. signed an agreement for technical collaboration with Bristol Aero-Engines in November 1955, and under the terms of this document the Orpheus will be manufactured in Italy by Fiat should the number required justify



KEY TO DRAWING

1 Intake rubber sealing ring
2 Intake pitot
3 Starter breeches
4 Gas feed pipe
5 Turbo-starter
6 Shaft extension for front bearing and accessory drive
7 Fourth-stage air to interior of compressor and shaft
8 Duplex burners located from ends of flame tubes
9 Turbine stators (nozzle guide vanes) integral with flame tubes in groups of nine
10 Stator sliced through to show hollow swaged construction
11 Construction permits axial and radial float without gas leakage
12 Cooling-air pipe for rear bearing with control oil feed
13 Combined control unit
14 Lucas GD fuel pump
15 Fixed inlet guide vanes
16 Magnesium-aluminium cage intake

ISTOL ORPHEUS BOr.3 Mk 803

his drawing, by Bristol Siddeley Engines, depicts the standard Orpheus turbojet now in bulk roduction for tactical fighter and strike aircraft. The inherent simplicity of the engine is reflected in the rapid achievement of a standard of reliability and ease of repair which is only after several years of intensive operation. Other types of Orpheus have bleed-air de-icing and have different accessory configurations

the expenditure on tooling. It is also appropriate to note that for many years SNECMA have been the French licensees of Bristol engines, and this agreement would permit them to manufacture the Orpheus should this be necessary. Licence negotiations have also been opened with B.M.W., a world-famous West German company. In the U.S.A. a licence to manufacture the Orpheus as the TJ-37 is held by the Wright Aeronautical division of the Curtiss-Wright Corpn.

While the firm market for the Orpheus was materializing for the NATO strike machines, the enterprise of Folland Aircraft was being rewarded by increasing foreign interest in the Gnat. The first, and most important, order to be received was that from the Indian Government, who in September 1956 signed a contract for 25 Gnat Mk 1s, supplied from Folland, together with parts for a further 15 for assembly by Hindustan Aircraft (leading to an eventual all-Indian machine). At the same time the courageous step was taken of establishing a factory at Bangalore for the manufacture of the Orpheus. This was the first decision to manufacture a gas-turbine in non-Communist Asia. The engines, which should begin to appear this year, will be employed initially in Gnats constructed wholly by Hindustan Aircraft, but the advanced BOr.12 may later go into production for an indigenous fighter (as described later).

Second country to adopt the Gnat was Finland. Late in 1956 the Finnish Air Force decided to purchase twelve Gnat Mk 1s (which have been delivered) and plans are in hand to manufacture the Gnat airframe in Finland. For this purpose Bristol-built engines will be supplied initially, but Finland may decide to make the engine under licence. Last summer two Gnat Mk 1s were delivered to Yugoslavia for evaluation, and the type may be adopted—and possibly manufactured—by that country.

Today the standard production NATO engine is the Orpheus 803. This differs from the 801 chiefly in having several very minor improvements, such as blade-polishing, which have combined to raise the rating to 5,000 lb. Other data appear on the tinted panel at the foot of this column. Total running time for engines of BOr.3 standard now amounts to some 15,000 hr. Engines are being sampled to confirm an initial life with user squadrons of 150 hr, and this figure should soon be increased. The corresponding time for the Mk 701 (BOr.2) of the Gnat Mk 1 is 200 hr.

Although initially designed strictly for combat purposes, the simplicity and reliability of the Orpheus have made it an attractive powerplant for trainers. Most important of the trainer engines is the BOr.4, which was announced early in 1957 as the powerplant of the forthcoming Gnat T.1 for the Royal Air Force. Although almost identical to the BOr.2/3, the trainer engine has a turbine of increased size and a rating of only 4,230 lb. The resultant reduced turbine inlet temperature and compressor speed gives lower specific fuel consumption and will almost certainly permit the attainment of an exceptional overhaul life, extended components-lives and consequent low-cost operation. The BOr.4 is the standard engine for the Fuji TIF-2 transonic trainer now under development for the Japanese Air Self-defence Force. As an alternative powerplant it is available for the North American Model 249 (T2J-1) naval trainer.

Although operating economy was not a dominant factor in the engine's basic design, the specific fuel consumption of the Orpheus is by no means uncompetitive with other engines in its class and a commercial version—with different accessories, steel first-stage compressor rotor blading and full de-icing—has already been planned for light transport aircraft. The first machine in this category to use the Orpheus was the Lockheed Jetstar, initially planned to meet the U.S. Air Force UCX requirement for a crew-readiness trainer and executive transport. This specification called for four engines, but the non-availability of American powerplants caused Lockheed to approach Bristol, and the fitting of two relatively low-powered Orpheus—supplied by Bristol's American licensee as the Wright TJ-37—permitted the first prototype to fly on September 4, 1957.

So outstanding was the performance of these engines, and of the 4,850/5,100 lb-thrust Orpheus 810s which were later fitted, that similar powerplants were installed in the second prototype and a twin-Orpheus production version was also planned. In a recent paper on the Jetstar, Clarence L. "Kelly" Johnson, Lockheed's v-p. for advanced development projects, said: "These Orpheus engines . . . have been the best engines the writer has ever used in a prototype aircraft. They were and are so good that it was decided at an early date to make all Jetstars from serial number two up capable of using two Orpheus engines [as an alternative to four American units]. The Orpheus version . . . is fully competitive in performance (except with one engine out) and will be offered to those who want its lower cost, simplicity and—at least for some time—reliability."

Rather larger transports have now been developed around the engine. Three important British projects are the Hunting H-107 (two Orpheus), the Handley Page H.P.113 (two Orpheus providing propulsion and shaft power to blowers for boundary-layer control) and the Bristol 205 (a 58-seat airliner employing four Orpheus or two more powerful engines).

Most of the aircraft so far mentioned employ engines of essentially BOr.3 type, with a rating of either 4,850 lb-thrust (Mk 801) or 5,000 lb thrust (Mk 803). The essential features of these extremely simple engines can be deduced from the cutaway drawing, but a few words of amplification are necessary.

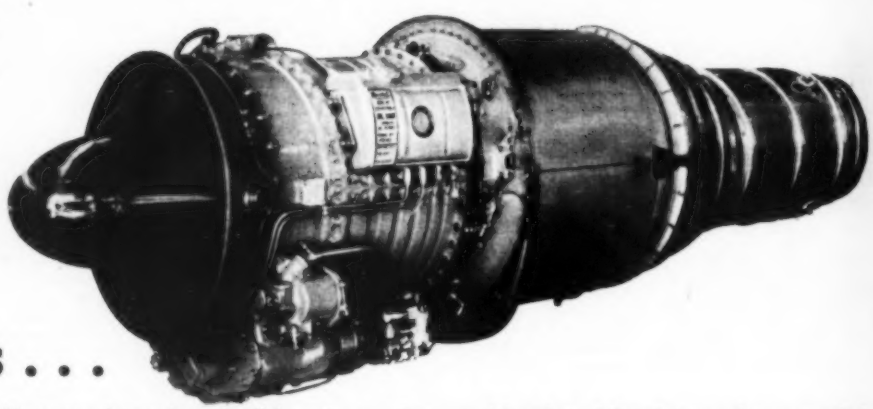
Owing to its modest length and considerable rigidity, the main rotating assembly is supported in only two bearings, a ball thrust bearing being mounted ahead of the compressor and a roller bearing being situated behind the turbine. The compressor rotor

ORPHEUS MK 803

Single-shaft turbojet. Fixed intake geometry, seven-stage axial compressor driven by single-stage turbine, can-annular combustion chamber with seven flame tubes and burners and two igniter plugs, fixed exhaust system, shaft drives to fuel pump and accessories and provision for bleeding air.

Overall diameter (common to all Orpheus), 22.4in; length from intake flange to exhaust cone, 73.45in; equipped dry weight, 825 lb; maximum rating, 5,000 lb dry thrust at 10,000 r.p.m. with mass flow of 84 lb/sec, pressure ratio of 4.4:1 and specific fuel consumption of 1.0lb.

The engine is dismantled in the vertical position. Above, one of the seven flame tubes has been removed; this can be done even with the turbine rotor in position



Standard NATO Orpheus is the Mk 803 (right), of BOr.3/2 rating. The engine depicted is for a Fiat G.91, and differs slightly from the engine depicted in cut-away form on the previous two pages

ORPHEUS . . .

accepting air delivered by a Palouste compressor. Either of these units accelerates the engine very rapidly, and the high-pressure starter achieves light-up in about 4 sec for a consumption of some 6 lb of air.

Most NATO Orpheus 801s and 803s drive a 4 kW Labinal generator and one or two Messier hydraulic pumps. As the large cut-away drawing indicates, the shaft power for the accessory drives is extracted from the front of the extension shaft ahead of the compressor, a bevel gear engaging with a similar gear on a vertical shaft passing down at "six o'clock" to a gear train on the underside of the compressor casing. Around the delivery casing at the rear of the compressor are disposed four bleed points through which hot air may be extracted for de-icing the forward end of the engine, heating fuel filters, pressurizing the tankage, de-icing the airframe and providing cabin pressure air either directly or by driving air-turbine motors. (In the two prototype Jetstars air-turbine motors are used to drive the D.C. generators and hydraulic pumps, but this arrangement is non-standard.) The engine for the projected H.P.113 is provided with a forwards extension from the main rotating assembly so that, via a universally jointed shaft, shaft power may be transmitted to high-capacity four-stage axial blowers to extract air through the porous skin over the wings and empennage.

Owing to the fact that the basic BOr.3-type Orpheus has an exceptional amount of inherent inbuilt "stretch" it is logical to expect Bristol Siddeley to extend the performance of the engine for both military and civil purposes. Little can be said of the advanced military engines, beyond referring to the advanced BOr.12 later in this account; but something can be revealed of the improved commercial engines. Like other manufacturers on both sides of the Atlantic, Bristol Siddeley are likely to offer a transport Orpheus with a two-position nozzle, in order to achieve optimum operating conditions both at sea-level for take-off and for high-altitude cruise. The BOr.8/10 stage 2, for example, matches a larger turbine, of BOr.4 pattern, with such a nozzle, and has a rating of 5,430 lb for a weight of 960 lb.

As already noted, the initial design rating of the first-generation Orpheus is 4,850 to 5,100 lb. It has long been appreciated that there is considerable capacity for refinement and further development inherent in the engine, and a new generation of Orpheus, with substantially increased ratings, is now being prepared by Bristol Siddeley Engines. It would be logical to assume that these new engines will have a zero stage on the compressor, in order to effect an appreciable increase in mass-flow and pressure-ratio. First of the advanced Orpheus is the BOr.11, which, for a weight increase of some 160 lb and about 4in of extra length, gives almost 1,000 lb more thrust, probably in conjunction with improved specific consumption. A closely related engine is the BOr.12SR military unit which, with Bristol simplified reheat, will have an initial maximum rating of 8,000 lb.

Both these engines have completed a considerable amount of bench running and a photograph of a BOr.12 appears on p. 219. As the more powerful series of Orpheus have the same diameter as their predecessors they are installationally suitable for many aircraft planned for the less-powerful engines, and it is expected that the Bréguet Taon, and probably other European strike machines, will eventually appear in developed form with the BOr.12. In November 1957 this journal announced that two-seat multi-purpose versions of the Taon and Etendard were being offered with the new engine, and the BOr.12 has also been suggested as an alternative powerplant for certain aircraft currently using the Atar.

It is logical that the BOr.12 should be designed for flight Mach numbers well in excess of unity, and some exceedingly fast aircraft are undoubtedly being planned to use this engine. In Spain Professor Willy Messerschmitt is well advanced with the design

comprises seven discs separated by spacer rings and carrying light-alloy blades with fir-tree root attachments. Except for two stator rows the whole compressor is made of aluminium alloy. The single-stage turbine is attached to a thin-walled, large-diameter drive shaft which is through-bolted at its forward end to the rear-most compressor disc. A novel feature (unique at the time of the engine's design) is the incorporation of the turbine stator blades, or nozzle guide vanes, in the rear portions of the seven flame tubes. As a photograph shows, each flame tube is fabricated to assume a section at the rear end corresponding to a segment of the turbine entry, and within this segment are mounted nine hollow welded stators. Each flame tube is located at its forward end on its associated burner, the delivery end being free to slide axially.

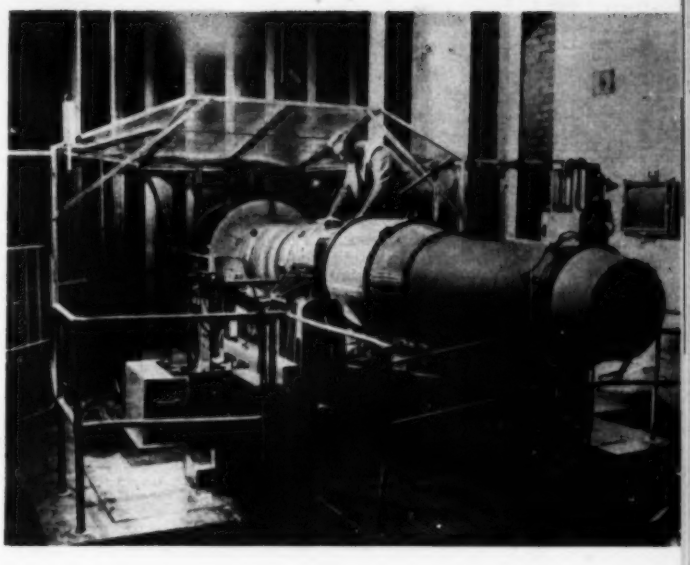
Lubrication is effected by a simple system comprising a main pressure pump feeding the thrust bearing, two scavenge pumps to extract the return from this bearing and from the accessory drives, and a metering pump which feeds a calibrated flow of specially filtered oil to the rear bearing, this flow being dumped overboard by the jet pipe. Oil is carried in a separate tank, usually of 1.75 Imp. gal capacity, which is attached to the left-hand side of the compressor casing. There is no oil cooler. The standard fuel system is by Lucas and incorporates a GD-type pump, a combined control unit giving automatic control from a single cockpit power lever and H.P. cock, and a manifold to the seven Duplex burners. A j.p.t. limiter is employed in certain marks of Orpheus.

Engines for the NATO aircraft generally use a cartridge starter, the usual pattern being a B.T.H. two-shot system fitted with twin breeches mounted on the compressor casing and feeding through an external pipe. Alternatively, a pneumatic starter may be fitted, and two patterns of air starter have been developed for the engine by Rotax Ltd. For the BOr.2 Mk 701 a high-pressure cold-air starter has been devised, giving an output of up to 43 b.h.p. and weighing 19.95 lb. This starter operates on air with a supply pressure from 250 to 320 lb/sq in, the consumption rate varying from 0.8 to 1.0 lb/sec. In contrast, the BOr.3 may be fitted with a low-pressure, high-temperature pneumatic starter capable of

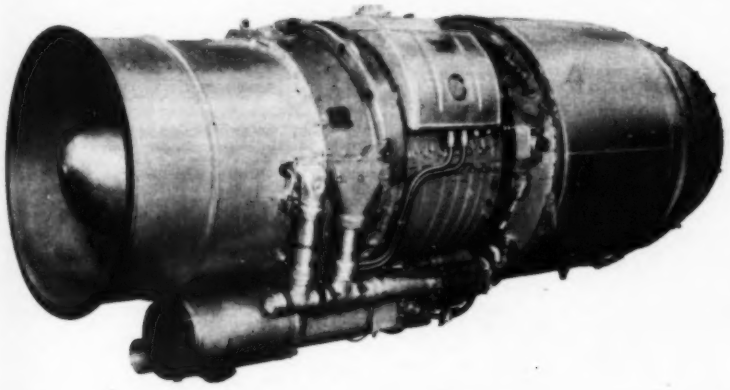
of the Hispano HA.300 intercepter, and although little is known of this aircraft it is clear that it will be supersonic. Another noted German designer, Professor Kurt Tank, has for a considerable period been engaged in the design of an advanced all-weather intercepter at the Bangalore works of Hindustan Aircraft Ltd. Here again the aircraft is shrouded in secrecy, but one of *Flight's* staff who visited Bangalore recently suggested that twin BOr.12s might be a safe speculation. A third supersonic Orpheus-powered machine is the Italian Aerfer Leone, in which a single afterburning engine is employed—perhaps combined with a rocket.

Owing to their substantial increase in mass-flow and high component efficiencies, these advanced types of Orpheus could form an excellent basis for a commercial transport powerplant. It may be expected that some of the airliners for which the Orpheus is specified (see table) may appear with an engine of something in excess of 6,000 lb thrust developed to a time-scale corresponding to that of the airframe. Such engines would doubtless have two-position nozzles, and one of the most advanced would be rated at 7,130 lb dry sea-level thrust and weigh 1,220 lb. It would suit a late-model Jetstar admirably.

During its first comprehensive test last year the BOr.12 easily achieved its brochure figure of 6,810 lb at the design turbine entry temperature, and with a specific consumption well below the estimated value. Development is going ahead rapidly, both for commercial purposes and, with Bristol Simplified Reheat as the BOr.12SR, for military aircraft. The strip after a recent 24-hr special category endurance test was excellent; work scheduled for the coming year includes full flight-testing and the first 150-hr type test, and production BOr.12s should appear next year. Total bench hours on all Orpheus are currently some 12,000 (see graph below) and flight time is about 5,600 hr.



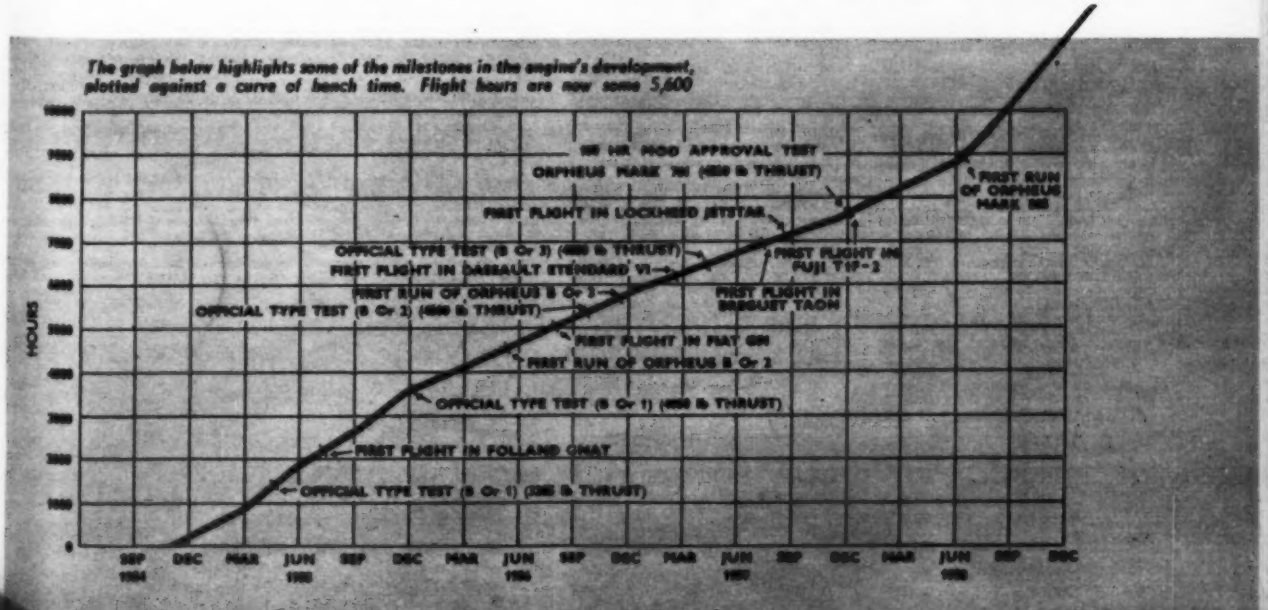
Most powerful member of the Orpheus family is the BOr.12, rated at 6,810 lb dry thrust. Here a BOr.12 is engaged in bench-running at the Patchway (Bristol) facility of Bristol Siddeley Engines



First of the transport versions of the Orpheus is the Mk 810 (left), of BOr.3/5 rating of 4,850/5,100 lb. Fully de-iced, and equipped with much revised accessories, it affords an instructive comparison with the fighter engine illustrated on the opposite page

In conclusion, it is appropriate to suggest a fan derivative of the basic engine. It has many times been reported unofficially that such an engine is under development for the Hawker P.1127 strike aircraft—officially described merely as having a "special Bristol engine"—to meet a NATO requirement. It has been said that the development of the fan engine is being supported by the U.S. Government under the Mutual Weapons Development Programme. Owing to the large diameter of the compressor driveshaft it should be entirely practicable to pass a second shaft down the centre of the engine connecting a low-pressure turbine to a forward low-pressure fan section, which might well consist of upstream compressor stages from a late-model Olympus. Such an engine would undoubtedly combine very high thrust with exceedingly low specific fuel consumption and installed weight, and, since it would be assembled from well-proven components, might well become available for use within a relatively brief period.

The graph below highlights some of the milestones in the engine's development, plotted against a curve of bench time. Flight hours are now some 5,600



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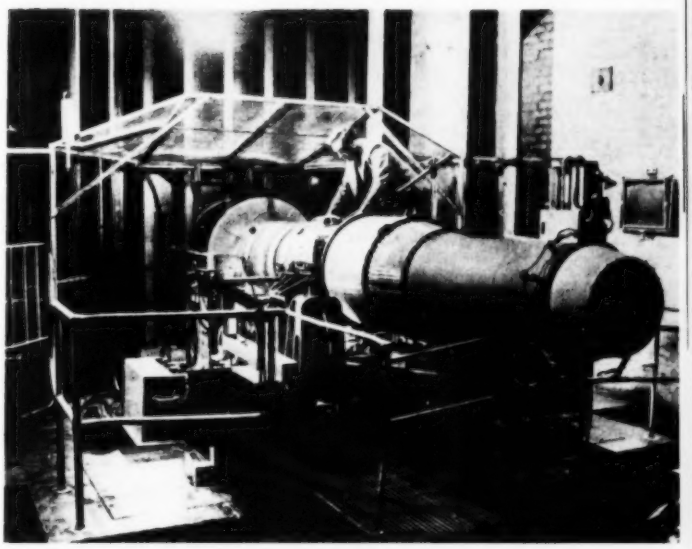

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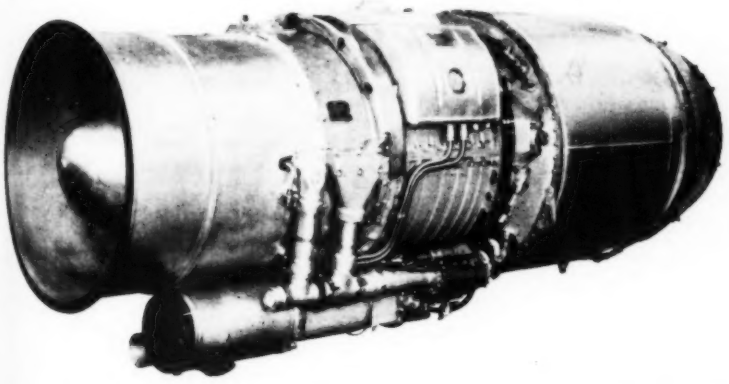

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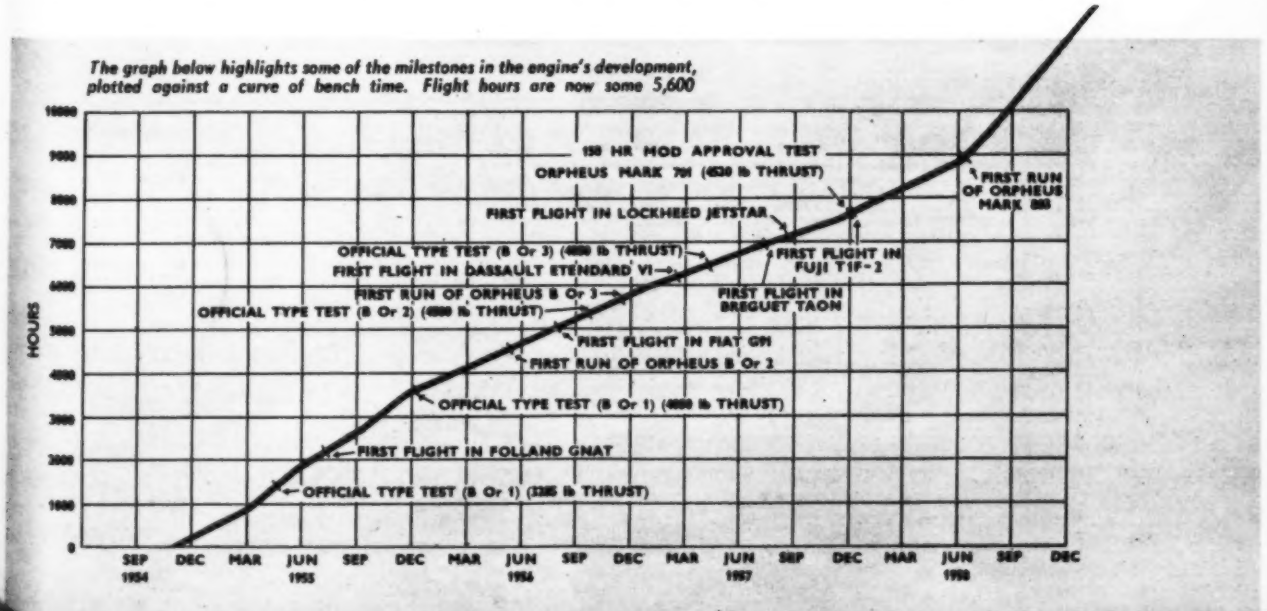


Proven Performance

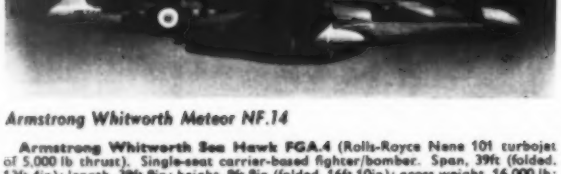
NEWLY RELEASED DATA FOR BRITISH MILITARY AIRCRAFT

Hawker Hunter F.4s

AS a result of a relaxation in their security classification, it is permissible to publish basic weights, tankage and performance figures for certain types of British military aeroplanes. Naturally enough, the types involved are not of the very latest design, but they are by no means obsolete and still equip an important proportion of the front-line squadrons of the Royal Air Force and Royal Navy. The figures have been supplied by the manufacturers concerned, and can be relied upon implicitly.

Armstrong Whitworth Meteor NF.11 (two Rolls-Royce Derwent 8 turbojets of 3,500 lb thrust each). Two-seat night and all-weather fighter. Span, 43ft; length, 48ft 6in; height, 13ft 10in; basic operating weight, 12,260 lb; gross weight, 18,567 lb; max. wt. with two 100-gal drop tanks, 20,357 lb; take-off to 50ft (zero wind), 4,200ft at 20,050 lb or 3,600ft at 18,567 lb; rates of climb with ventral and under-wing tanks (705 gal total) taking off at 20,050 lb, 6,000ft/min at sea level, 4,100 at 10,000ft, 3,000 at 20,000ft and 1,000 at 40,000ft; times to height, 10,000ft in 2.5 min, 20,000 in 6 min and 30,000 in 11 min; level speeds (L= performance limited by aircraft restriction, figures in brackets are with ventral tank only), 435 kt or M 0.66 L (435, 0.66 L) at sea level, 482 kt M 0.75 L (500, 0.78) at 10,000ft, 475 kt M 0.77 L (487, 0.79) at 20,000ft, 465 kt M 0.79 (470, 0.8) at 30,000ft, 455 kt M 0.79 (460, 0.805) at 40,000ft; full-load single-engine performance (14,700 r.p.m., figures in brackets are ventral tank only), rate of climb at sea level 1,130ft/min (1,480), rate of climb at 20,000ft negative (+270), service ceiling for +100ft/min 18,000ft (23,000), level speed 280 kt at sea level (325 kt) or 250 kt at 20,000ft (295 kt); landing from 50ft, 4,500ft.

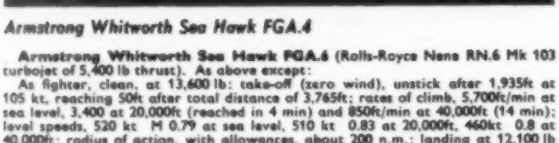
The Meteor NF.12 has Derwent 9 engines and an improved radar which increases the length to 50ft and requires a larger fin area; the Mk 13 has cockpit refrigeration but otherwise resembles the Mk 11; the Mk 14 is the Mk 12 with a new canopy and windscreen. Their performance differs only slightly from that of the Mk 11.



Armstrong Whitworth Meteor NF.14

Armstrong Whitworth Sea Hawk FGA.4 (Rolls-Royce Nene 101 turbojet of 5,000 lb thrust). Single-seat carrier-based fighter/bomber. Span, 39ft (folded, 13ft 4in); length, 39ft 8in; height, 8ft 8in (folded, 16ft 10in); gross weight, 16,000 lb; max. landing weight, 12,100 lb; take-off at max. wt. (zero wind), unstick after 3,150ft at 115 kt, reaching 50ft after total distance of 4,800ft; rates of climb (two external tanks and bomb load), 4,200ft/min at sea level, 2,500ft/min at 20,000ft (reached in 6.2 min) and 900ft/min at 35,000ft (15.6 min); max. level speed, 450 kt (M 0.68) at sea level, 470 kt (0.765) at 20,000ft, 445 kt (0.775) at 35,000ft; max. wt. landing (zero wind), approach at 115 kt, ground run 2,700ft, total distance from 50ft is 4,200ft.

The lighter (13,200 lb) Sea Hawk F.1 achieves 510 kt clean, climbs at 6,200ft/min, reaches 35,000ft in 8.6 min and still climbs at 2,400ft/min at that height, unsticks at 105 kt after 2,010ft and reaches 50ft in 3,300ft.



Armstrong Whitworth Sea Hawk FGA.4

Armstrong Whitworth Sea Hawk FGA.6 (Rolls-Royce Nene RN.6 Mk 103 turbojet of 5,400 lb thrust). As above except:

As fighter, clean, at 13,600 lb: take-off (zero wind), unstick after 1,935ft at 105 kt, reaching 50ft after total distance of 3,765ft; rates of climb, 5,700ft/min at sea level, 3,400 at 20,000ft (reached in 4 min) and 850ft/min at 40,000ft (14 min); level speeds, 520 kt M 0.79 at sea level, 510 kt 0.83 at 20,000ft, 460kt 0.8 at 40,000ft; radius of action, with allowances, about 200 n.m.; landing at 12,100 lb (zero wind), approach at 115 kt, ground run 2,400ft, total distance from 50ft is 3,750ft.

As fighter/bomber, with two 100-gal tanks and two 500 lb bombs, at 16,200 lb; take-off (zero wind), unstick after 3,450ft at 118 kt, reaching 50ft after a total distance of 5,790ft; rates of climb, 4,720ft/min at sea level, 2,340 at 20,000ft (reached in 5.8 min) and 750 at 35,000ft (16.8 min); level speeds, 450 kt M 0.68 at sea level, 450 kt 0.73 at 20,000ft, 455 kt 0.77 at 35,000ft; radius of action, with allowances, about 250 n.m.; landing at 13,300 lb (zero wind), approach at 120 kt, ground run 2,700ft, total distance from 50ft is 4,080ft.

Avro Shackleton MR.3 (S.A.A.F.)

Avro 696 Shackleton MR.3 (four Rolls-Royce Griffon 57A piston engines of 2,455 h.p. each). Ten-seat maritime-patrol aircraft. Span (over tip tanks), 119ft 10in; length, 92ft 6in; height, 23ft 4in; gross weight, 100,000 lb; normal cruising speed, up to 220 kt; typical cruising range at 1,500ft with full military load, 3,180 n.m.; at a radius of 1,000 n.m. from base the MR.3 can conduct a 9 hr search with radome extended.

de Havilland 112 Venom FB.4 (D.H. Ghost Mk 103 turbojet of 4,850 lb thrust). Single-seat fighter/bomber. Span (over tip tanks), 41ft 8in; length, 33ft; height, 6ft 8in; normal war load, four 20mm guns with 600 rounds plus either two 1,000 lb bombs or two 500 lb bombs and eight 60 lb R.Ps. or similar stores; fuel capacity, including tip-tanks but excluding two 80-gal drop tanks, 489 Imp. gal; gross weight with underwing stores, 15,310 lb; sea-level rate of climb (combat r.p.m. at 11,500 lb), 7,230ft/min; times to height, 20,000ft 4.5 min, 30,000ft 7 min; 45,000ft 14.3 min; level speeds at mean weight, 519 kt (M 0.785) at sea level, 500 kt (0.815) at 20,000ft, 484 kt (0.820) at 30,000ft, 468 kt (0.817) at 40,000ft, 461 kt (0.805) at 45,000ft; patrol duration, allowing for take-off, climb, 10 min combat and descent, 1.35 hr at sea level at 175 kt, 2.25 hr at 20,000ft at 235 kt and 2.45 hr at 40,000ft at 340 kt.

de Havilland Sea Venom FAW.22

de Havilland 112 Sea Venom FAW.22 (D.H. Ghost Mk 105 turbojet of 5,300 lb thrust). Two-seat carrier-based all-weather fighter. Span (over tip tanks), 42ft 10in; length, 36ft 8in; height, 8ft 6in; normal war load, four 20 mm guns with 600 rounds plus eight 60-lb R.Ps.; fuel capacity, 461 Imp. gal (can be supplemented by two 50-gal drop tanks in place of underwing stores); gross weight, with R.Ps., 15,800 lb; max. wt. take-off (zero wind), 4,230ft to 50ft; rates of climb (combat r.p.m. after max. wt. take-off), 5,900ft/min at sea level, 3,700 at 20,000ft and 2,600 at 30,000ft; operational ceiling (1,000ft/min), 40,000ft; level speeds with tip-tanks only, 500 kt at sea level, 494 kt at 20,000ft, 461 kt at 40,000ft; still-air range at 35,000ft with drop tanks, 612 n.m.; radius of steady turn at 30,000ft, 1.8 n.m.; patrol duration at 30,000ft, 2.11 hr (1.73 hr with full allowances, including 20 min loiter at 20,000ft).

English Electric Canberra B.2 (two Rolls-Royce Avon RA.3 turbojets of 6,500 lb thrust each). Three-seat high-level bomber. Span, 63ft 11½in; length, 65ft 6in; height, 15ft 7in; normal gross weight, 44,500 lb (40,500 without tip tanks); max. gross weight, 46,000 lb; internal fuel capacity, 1,377 Imp. gal (1,865 gal with tip tanks); bomb load, 6,000 lb; take-off (zero wind) to 50ft at max. wt., 4,590ft (3,540ft without tip tanks); rate of climb at sea level at full load, 3,800ft/min; level speeds, 450 kt M 0.68 at sea level, 495 kt M 0.82 above 30,000ft; limiting altitude determined by pressure-breathing system, 48,000ft; max. still-air range with full bomb load, 2,310 n.m.; ferrying range, 2,597 n.m.; landing from 50ft, 4,500ft at max. landing wt. of 40,000 lb or 2,520ft with only 250 gal fuel.

Canberra PR.3. As above except: length, 66ft 8in; normal gross weight, 44,000 lb (40,000 without tip tanks); internal fuel capacity, 1,917 Imp. gal (2,405 with tip tanks); no bombs; take-off to 50ft, 4,410ft (3,450 without tip tanks); max. still-air range, 3,115 n.m. (ferrying, 3,180).

Canberra T.4. As B.2 except: normal gross weight, 37,000 lb (33,000 without tip tanks); internal fuel capacity as B.2; take-off to 50ft, 3,120ft (2,370ft without tip tanks); rate of climb at sea level, 4,300ft/min; max. still-air range, 2,700 n.m.; landing from 50ft, 3,450ft at max. landing wt. of 31,500 lb.

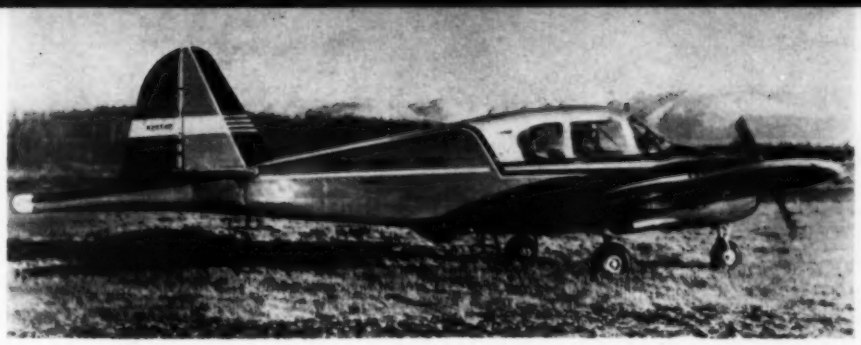
The Canberra B.5, U.10, T.11 and T.13 are closely related to (respectively) the B.2, B.2, T.4 and T.4.

English Electric Canberra PR.7 (two Rolls-Royce Avon RA.7 Mk 109 turbojets of 7,500 lb thrust each). Span, 63ft 11½in; length, 66ft 8in; height, 15ft 7in; normal gross weight, 53,000 lb (49,000 without tip tanks); internal fuel capacity, 2,817 Imp. gal (2,305 gal with tip tanks); take-off (zero wind) to 50ft, 4,755ft (3,360 without tip tanks); rate of climb at sea level, 3,600ft/min; level speeds, as B.2 at sea level, 504 kt M 0.83 at 40,000ft; max. still-air range, 3,821 n.m.; landing from 50ft, 3,900ft at max. landing wt. of 40,000 lb or 2,320ft with only 250 gal fuel.

The Canberra B.6, B(I).6 and B(I).8, and their export derivatives are not likely to differ very greatly from the PR.7, although the precise data for these variants may not yet be published.

Hawker P.1067 Hunter F.4 (Rolls-Royce Avon RA.21 Mk 115 or 113 turbojet of 8,050 lb thrust). Single-seat fighter/bomber. Span, 33ft 8in; length, 45ft 10½in; height, 10ft; normal gross weight (clean, in intercepter role), 17,100 lb; max. gross weight (long-range ground-attack role with two 1,000 lb bombs and two 97-gal drop tanks), 21,200 lb; internal fuel capacity, 410 Imp. gal (max. fuel normally 798 gal with four 97-gal drop tanks, although 230-gal tanks can theoretically be carried); max. wt. take-off (zero wind, dry runway, etc.), 3,990ft to 50ft; rates of climb (clean, ¼-fuel, max. r.p.m.), 10,500ft/min at sea level, 8,400 at 20,000ft, 3,100 at 40,000ft, 1,700 at 45,000ft and zero at 52,000ft; times to height (same conditions), 1.4 min to reach climbing speed from brakes off, 2.25 min to 20,000ft, 6.15 min to 40,000ft and 8.45 min to 45,000ft; level speeds (clean, ¼-fuel), 610 kt M 0.925 at sea level, 573 kt 0.935 at 20,000ft, 533 kt 0.93 at 40,000ft, 525 kt 0.915 at 45,000ft; landing with 100 gal fuel remaining over 50ft, total distance 3,900ft. (The F.4 has been flown to limits of 635 kt e.a.s. in conjunction with M 0.955 and to M 1.23 in conjunction with about 500 kt e.a.s.)

English Electric Canberra B.2s



Magnetometer-equipped Apache operated by Aero Service Corporation in search for new mineral resources in Alaska. News item on this page reports flight of similarly equipped Apache to Korea

Sport and Business

THE AIR LEAGUE, its history and aims formed the subject of a talk at the Kronfeld Club on Wednesday, February 4, by A. Cdre. G. J. C. Paul, the League's secretary-general. The talk, he explained, was the prototype of one he hoped to give to flying and gliding clubs throughout the country during this year, in an endeavour to recruit more members for the League. 1959 was the organization's 50th anniversary year, and an Air League history was being written for the occasion by Gavin Cochrane (previously Exchange Telegraph air correspondent and now an executive of Sidney-Barton Ltd., the firm which handles the League's public relations).

In many respects, A. Cdre. Paul suggested, the years 1909 and 1959 were "not dissimilar." At the time of the formation of the League, and again today, there was a great interest in aviation in spite of official discouragement. The speaker went on to detail the activities of the League during the inter-war period and to mention its plans for the future—which were to be amplified on the anniversary occasion in April.

In the period of discussion and questions after the talk the air commodore asked for—and received—criticism of the League and of his presentation as a recruiting medium. Were there not already sufficient separate organizations dealing with sporting flying, and were not the Air League council-members out of touch with practical flying? Certainly a united sporting-flying movement was needed, A. Cdre. Paul replied, but the Air League's interests included defence affairs and so were wider than those, for instance, of the Royal Aero Club. As for the council-members, if all those present that night at the Kronfeld joined the League and came along to its annual meetings, they could most effectively influence the election of the council. Why was the Air League not represented on the recently formed M.T.C.A. standing joint committee on private aviation? A. Cdre. Paul said that he, too, wanted to know the answer to that one.

Other points arising from the discussion were that the speaker personally did not believe that the anticipated results nor this country's resources justified Britain's entry into the space race, and the news that the president of the Air League, the Duke of Hamilton, had been invited to open this year's National Gliding Championships at Lasham.

FIRST SOCIAL EVENT to be organized by Sir W. G. Armstrong Whitworth Flying Group, a buffet dance on January 30 was attended by over 120 members and guests. On this occasion club vice-president F. Martin presented tankards to retiring committee-members N. Wilson, D. Javes, A. Thomson and R. Adams for their efforts for the group during their three years of office. The present committee comprises J. R. S. Nicholls, chairman; W. Johnson, vice-chairman; D. A. O'Clarey, secretary; and D. Dumbleton, treasurer.

The Armstrong Whitworth group, since its formation less than three years ago, has operated Tiger Moth G-ALWW. Total flying time logged during 1958 was 266 hr, with instruction in the hands of C.F.I. Norman Slater and Colin Woodward. Of the total membership of 60, 14 members now hold P.P.L.s and several are aiming at Assistant Instructor's ratings in the near future.

SURREY FLYING CLUB and most of the smaller Croydon groups were prevented by fog from flying their aircraft from Croydon to their new base at Biggin Hill on Sunday last, February 8. The transfer of most of the Surrey club's furniture and clubhouse equipment, however, was completed by road as planned. The only aircraft to fly from Croydon to Biggin on that day was Tiger Moth G-OAES of 600 Squadron (City of London) Flying Club.

A PIPER APACHE fitted with a tail magnetometer sting was recently flown across the mid-Pacific from Oakland, California, to Seoul, Korea. Owned by Aero Service Corporation of Philadelphia and delivered by a two-man crew from Skyways Aircraft Ferrying Service, Van Nuys, California, the machine is to be used to obtain mineral-survey data for the Republic of Korea.

The 8,300-mile delivery flight was made by Jack H. Ford, chief pilot of Skyways A.F.S., and Walter A. Henderson, chief navigator, and their route was Oakland - Honolulu - Wake Island - Tokyo - Miho - Seoul. Cabin tanks provided an extra 200 gal of fuel. At Seoul the aircraft was handed over to representatives of Aero Service Corporation.

The first Apache to be delivered to Korea was flown by Max Conrad over a North Pacific route *via* the Aleutians last summer, and the more recent flight of the Aero Service machine is said to be the first Apache flight across the mid-Pacific.

RETROSPECT

From "Flight" of February 13, 1909

Flight at the Coliseum: A new "turn" was put on at the London Coliseum this week, entitled M. Noiset and his flying bicycle, and, judging by the nature of the performance, it would seem as if this latest "star" from France will have very good reason to wish to fly on his own before he and his machine and the revolving stage have had a much more extended acquaintance. M. Noiset looks comfortable enough so long as he remains securely aloft in the air, and the extraordinary arrangement of drapery which adorns his bicycle successfully obscures his blushes from the audience—as well it may. Once he has blown that fatal whistle which is the signal for his descent on to his little revolving stage, however, the trouble—or the fun, according to the point of view—commences. We can conceive that it might not be an easy feat to maintain perfect composure, even when alighting on *terra firma*, while seated on a motor bicycle in full action, even if the machine is supported—by wings. But to be expected to make a landing on a wobbling revolving stage must surely be beyond a joke, and as M. Noiset does not profess to be either an acrobat or a trick cyclist, and gives no indication of having a special aptitude for either of these very honourable professions, we can thoroughly sympathise with his feelings, as he is caught by the whirling stage and is more or less speedily swept over the edge of the table, what time the curtain descends to hide the climax.

INSTRUCTIONAL LECTURES on gliding and glider maintenance are to be held at the Kronfeld Club under the auspices of the British Gliding Association. Beginning on February 19 at 8 p.m. and continuing for a further three successive Thursday evenings, Ray Stafford-Allen will give a course on the various aspects of glider maintenance. The charge for the complete course is 10s, or 3s per lecture. The same fees apply to the instructional lectures on gliding to be given by Derek Piggot on Monday evenings at 7.30 p.m. beginning on March 9 and ending on March 31. Further details of both courses are obtainable from the British Gliding Association.

YORKSHIRE AEROPLANE CLUB, which ceased operations in March last year, is to get a new lease of life. The club is to be re-opened at Yeadon Airport, thanks mainly to the efforts of Mr. Frank Leach and Mr. Albert Barker. The new club virtually replaces the Yeadon Aero Club, whose activities were suspended following the taking over of Yeadon Airport by the Leeds and Bradford Joint Aerodrome Committee. Also flying from Yeadon at present are members of the Yorkshire Flying Group, previously at Sherburn.

Prototype of the Sipa 1000 Coccinelle two-seater (65 h.p. Continental) seen at Toussus le Noble recently. Note large-area tail surfaces

Straight and Level

FOR the attention of those airlines who provide passengers with post-cards, and then generously stamp and post them free of charge, I quote this Reuter message of February 9:—

"When Mr. James Harvey, a Texan, stepped from a T.W.A. airliner at London Airport today he handed a surprised air hostess 198 cards he had written during flight. 'This is a great new idea,' he said."

A T.W.A. spokesman estimated later that the postage amounted to about £7. "We are glad that the scheme is turning out to be so successful," he added.

I do not know whether David Ogilvy's young son Geoffrey will grow up to be as staunch a champion of British private flying as his father. I certainly hope so. Already he appears to be serving the more general cause of air transport: he is seen here with his father last summer testing the new Frankenstein "baby flotation cot"

● In a lecture entitled *What Have We Learned from Vanguard?*, at the recent American Rocket Society meeting in New York, Milton W. Rosen gave an honest appraisal of why the programme had not been more successful—why more had not been achieved, that is, than a grapefruit-size sphere likely to stay up there for 200 years.

The speaker made these points. Concentration on performance and schedule had resulted in reliability and simplicity becoming secondary considerations; use of production methods for making the vehicle made it difficult to incorporate design changes; and the extensive pre-flight testing might have led to "a less than optimum result." Furthermore, the project was conducted in a climate of excessive publicity.

Mr. Rosen, who is programme chief for propulsion development in the National Aeronautics and Space Administration, concluded thus:—

"We are involved in a serious business—affecting not only the future of science but the political standing of our country. We have been criticized for lagging behind our principal competitor. Some people have become scared and have sought various excuses—our lack of attention to the physical sciences, our preoccupation with high-finned automobiles—or simply that we started too late. There is a grain of truth in all of these statements, but they go far wide of the main point. We have the talent to make a good account of ourselves. It is more a question of leadership and morale. I firmly believe that we will gain the lead in our field when, and only when, we learn to conduct our work quietly and with dignity."

● The year 1957 was bad for air freight and the world rate of increase was only 9 per cent. Due to the business recession, 1958's rate of growth was a mere 1 per cent. Yet a lecturer recently declared that the 1957 freight-growth was 11 per cent, and that the recent temporary setback in freight business was mainly due to the use of unsuitable converted passenger aircraft.

The lecturer then displayed a graph purporting to show 1957 world passenger-miles and suggested that the growth rate for freight coincided almost exactly with the rate of passenger traffic increase—which was 16 per cent, not 9 per cent.

A glance at the I.C.A.O. traffic digest reveals the source of his error: instead of taking passenger-miles he took the number of *passengers*.

The easily verifiable facts are that the air freight market in the past has developed less rapidly and more erratically than passenger traffic.

● On rare occasions our American commercial competitors are caught napping; and when this happens they are very quick to catch up with whoever has had the audacity to get in front. A typical case concerns the by-pass turbojet. Several companies, in Germany, France, and even the U.S.A., and most of all in Britain, promoted double-flow engines from 1943 onwards. People like Pratt & Whitney and General Electric scarcely gave such new-fangled devices a second thought, until Rolls-Royce actually started selling Conways under their noses. Then, as I recently pointed out, they brought out their own rapidly converted engines, adopting the soubriquet of turbofan, or fan engine.

In the field of nuclear power generation, competition between America and Britain is, if anything, even more intense than in the field of supplying engines to airlines. From the outset Britain concentrated on the natural-uranium, gas-cooled reactor—a rather olde worlde device and, for that very reason, one which enabled us to acquire a commanding lead while America occupied herself with sophisticated reactors and laughed the gas-cooled concept to scorn. But now the American journal *Nucleonics* writes: "Not much more than a year ago 'gas-cooled power reactor' was a term not to be found in the U.S. reactor designers vocabulary; but, at the Atomic Energy Commission's gas-cooled reactor information meeting this October, it was clear that the gas-cooled concept has overnight become a strong contender in the U.S. program."

Technical somersaulting is by no means a sport exclusive to aviation.

● "Soviet aviation tactics show no signs of being guided by considerations of commercial advantage, or by a desire to become a responsible member of the international aviation community.

"It might even be argued that the Soviet Union is not really interested in international aviation *as such*. Instead the Soviets seem to look upon aviation as just another device . . . to enhance their political-power position at relatively low cost to themselves." Hans Heymann, in the *Journal of Air Law and Commerce*.

● When the buildings and equipment at R.A.F. Worksop were put up for auction recently, the former officers' mess was described in the agent's catalogue as "forming an attractive detached bungalow."

Many people can no doubt devise similar terminology for places where they spent their war-time years. For example: "A barrack-block high on the Berkshire downs, presenting admirable landscapes on all sides, ideal for artist requiring solitude." Or perhaps: "A Nissen hut on the Lincolnshire wolds, cool even in summertime, excellent opportunities for studying widely varied insect life."

ROGER BACON

FEETNOTE: Space precludes my publishing the whole of this picture, so I offer this fascinating detail. The picture was taken at R.A.F. Akrotiri, Cyprus. It shows the C.A.S., Marshal of the R.A.F. Sir Dermot Boyle, admiring No. 27 Squadron's goat mascot (cloven hooves), which was introduced to him by an L.A/C. of the R.A.F. Regiment. What particularly appeals to me is the subtle distinction between a Leading Aircraftman and a Marshal of the R.A.F.

THIS article is a condensed version of a paper presented by Mr. R. C. Amsden, head of the applications section of the Fison organization's Chesterford Park research station, at the eighth National Power Farming Conference at Harrogate on February 11. The author has been concerned for some considerable time in the application of sprays and fertilizer by helicopter, and in the development of spray-gear for fixed-wing aircraft. The conference was jointly organized by the two journals "Practical Power Farming" and "Farmer and Stock-Breeder"

Aircraft in Agriculture

IN this country aircraft were first used experimentally in agriculture in 1947 for crop-spraying duties, and today this is still their major use. The growth in the use of spray aircraft is illustrated in the table below, the reasons for this increase including (1) development during and since the war of many new effective pesticides and weedkillers, (2) development of the helicopter, (3) availability of suitable surplus aircraft and spares after the war, (4) ever-increasing awareness of the farmer of the damage done to his soil and his crops by the use of heavy farm equipment, and (5) the general trend towards larger farming units and in some areas larger fields.

During 1957 and 1958 we had perhaps the worst outbreaks of potato blight of this century, and they coincided with exceptionally wet soil conditions—in fact the two circumstances were not entirely disconnected. The potatoes had to be sprayed with copper fungicide without delay, but for two or three weeks at a time the fields were often far too wet to stand the weight of a tractor and sprayer. Fortunately, there were more spray aircraft available than ever before, and it is estimated that at least 100,000 acres of potatoes were sprayed from the air in 1958 alone.

U.K. crop acreages sprayed by Fison Pest Control aircraft

Year	Acres	Year	Acres
1950	9,738	1955	13,642
1951	15,083	1956	14,165
1952	31,299	1957	50,000
1953	29,521	1958	57,239
1954	13,893		

Note: From 1956 to 1958 the number of operators increased from one to eight. Total U.K. acreages for these years will be much higher than the one-company totals shown

The availability of suitable fungicides was very nearly a limiting factor in this huge campaign, but the men behind the machines —the pilots, the engineers, field and supervisory staff—were worked right to the limit in the worst-affected areas. As a result, the spraying was done and the loss of crop was less than was expected.

It is usually true to say that it takes one season's work to make a good pilot into a good spray pilot. A man who is flying a light aeroplane some 5-12ft above a crop at 40-80 m.p.h. has a full-time job just flying. He is all the time sensing air movements through the controls, listening to his engine, checking the air speed, keeping one eye on fixed objects such as trees and overhead wires and the other eye open for moving objects such as birds and other aircraft. These things are vital to his survival, and he has several important gauges—indicating spray pressure, tank contents, oil pressure, fuel level, etc.—to check at intervals.

On every run he makes he has to fly straight over his flagmen, checking that they have not managed to get out of line. At the end of the run he has to shut off the spray with nice timing. In all this he must make due allowance for temporary changes of both wind-speed and direction, adjusting his height and position accordingly. In pulling up out of the crop he has to accelerate, climb over the trees and turn into wind—not banking too steeply or the part-filled spray tank may take control of the aircraft. Then he must align his aircraft up for the next run, throttle back and turn on the spray-cock just as he lowers himself down over the trees. The trees may be 150ft high, the crop over 40ft tall, and the nearest open space a mile or two away.

It is always dangerous to generalize about human beings, but it is often found that good spray pilots are very much individualists. Like all individualists they are not naturally good team-workers, and it can be a trying job organizing a team of pilots, engineers and ancillary staff on a new operation.

There is no traditional or cut-and-dried method for planning aircraft operations. Each job brings up its own problems and each terrain has its peculiar difficulties. Sometimes it is necessary to leave a pilot and engineer to carry on with routine spraying in an isolated area a thousand miles from base. There they may be faced with unexpected changes in local conditions (political, agricultural or meteorological) requiring decisions of a most unusual nature and needing clear thinking.

The men working on the ground have to be a good team. Whilst the aircraft is spraying, log sheets have to be filled in, refuelling requirements anticipated and spray chemical got ready. Filling has to be completed without mess or danger whilst the engine of the aircraft is running, and with helicopters it is usual to keep the time from touch-down to take-off below two minutes.

Lubricants, fuel and refuelling equipment have to be kept scrupulously clean and accounted for, water supplies vetted and chemical stocks checked against acreage sprayed. Errors in application rates have to be checked and necessary adjustments made to the spray-gear from time to time. Blocked nozzles are less common than on ground machines, but nevertheless do occur and have to be cleared. Any leaks, drips or serious accumulations of chemical on the aircraft fuselage or windscreen must be dealt with, and inquisitive children and stray cattle kept at a safe distance. Fire equipment and first aid must always be at the ready.

Spraying times for ten-acre field (220 × 220 yd)

Operation	Percival E.P.9	Tiger Moth	Hiller 12A
	sec	sec	sec
Average time per spray run	11.1	10.6	18.7
Average time per turn	32.9	19.0	15.2
	sec	sec	sec
Time flying to and fro landing site and field	360.0	350.0	125.0
Time filling on ground	350.0	200.0	120.0
Time for 11 spray runs	122.1	116.6	205.7
Time for 11 turns	361.9	209.0	167.2
Total time for 10 acres	21.7 min	14.6 min	10.3 min

For each man licensed to fly it is necessary to have two men on the ground. If you also include markers and tanker drivers this figure is nearer four. In this country the work is highly seasonal and requirements vary from year to year, but as a global operation the work carries on throughout the twelvemonth and may also include fertilizer top-dressing, anti-mosquito and locust spraying, locust swarm spotting, survey work, carrying oil-drilling equipment and so on.

In this country the work is mainly confined to crop spraying, but in time will undoubtedly include more and more fertilizer application, slug baiting, seed sowing, and possibly even straight haulage jobs in inaccessible places, e.g., dropping fencing materials on mountain pastures. Freight and passenger work in isolated districts and fire spotting and fire fighting are other possibilities, and in very adverse winters, of course, aircraft are already used for dropping fodder to farm animals.

The economics of agricultural spraying from the ground or by air are very difficult to assess. The cost of chemicals used by both methods is, of course, the same per acre, but the aerial contractor uses about ten times as much chemical per hour as would a ground applicator, so he may be able to purchase his chemical at an advantageous price. It is sufficient to say here that usually contract prices for aircraft spraying are about 50 per cent higher than for ground spraying. Usually a sliding scale of charges is made so that areas under ten acres may cost about 20 per cent more than areas over 200 acres, but reductions may be made in cases where two or three treatments are necessary.

For the farmer to pay this extra price willingly aircraft spraying has to have a number of advantages over ground spraying. The

AIRCRAFT IN AGRICULTURE . . .

enormous increase in aerial spraying in the last few years is some indication that the technique has real advantages to the farmer. In fact the advantages are numerous and have been described frequently elsewhere. The last two seasons, particularly, were very unfavourable for the use of heavy tractor-drawn sprayers, and there were many days when it was possible to carry out aerial spraying when the more orthodox machines were unable to move on to the flooded ground.

With the very rapid increase in aerial spraying activity a number of new firms have come into being who have little or no technical background and rely mainly on the experience of the pilots they have brought in. Now, continual research is going on into new techniques of aerial spraying, as well as into improved agricultural spray chemical specially formulated for aerial application.

Without extensive field trials to find out where the spray is actually going it is difficult for the operator to obtain a true picture of the efficiency of his technique. It is only after many years of field experience on a very wide range of crops under varying climatic conditions that an operator can build up the pros and cons of every available technique. He cannot do this and fly the aircraft himself—he, therefore, has to rely on technical staff in the field to tell him what sort of job he is doing and advise him on improvements, and today the aircraft spray operator is becoming more and more dependent on the backroom boys keeping him up to date with new techniques and new materials.

Aircraft have undoubtedly proved themselves capable of carrying out agricultural spraying in competition with tractors, and the advantages to the farmer have proved economically worth while—sufficiently so for us to be confident that they have come to stay. Farmers are, naturally and rightly, sceptical of new techniques, and they can see that there is room for improvement. Those who are in the lead of this new industry are developing improved techniques and new uses for aircraft with a frequency that is quite astonishing.

Hunters in Sweden

COMMENTS BY OFFICERS OF TWO FIGHTER WINGS

SIX squadrons of the Royal Swedish Air Force are equipped with the Hawker Hunter fighter—in Swedish service bearing the name J.34 Hawker Hunter. All these British fighters are based at two wings just outside Stockholm—F 18 Tullinge and F 8 Barkarby.

The first wing to get the Hunter was F 18, and there the fighter also initially saw service. F 18 has now had its Hunters nearly three years, and F 8 has had its own about two years. Thus the best Swedish source of information on the Hunter is F 18.

The Wing Commander Flying of the wing, Major Sven Lampell, is beyond doubt the best individual authority. He did a good deal of Hunter flying before the aircraft were delivered to Sweden, and he also has experience on Sabres. Furthermore, he is leader of F 18's Hunter aerobatic team, which on several occasions (among them Queen Juliana of the Netherlands' arrival in Stockholm for her official visit to Sweden) has given notable performances. This is briefly what Major Lampell had to say about the Hunter when interviewed last year: "It is indeed a wonderful aircraft in all respects, aerodynamically. It is a very 'kind' 'plane; a pilot's 'plane. It has very fine low-speed abilities and (a vital detail) it is perfect for instrument flying. There are no troubles at all—for instance in putting the wheels out while flying in cloud. The Hunter also has very fine supersonic qualities; no trim alterations are necessary. The 'hit probability' of the armament is high, and we are able to fire our weapons over relatively long ranges. This means good protection, for we can keep sufficient distance and yet hit our targets."

A point of criticism by Major Lampell was that he would like to have nose-wheel steering. "Maybe this is a special Swedish desire," he added, "but we do have some difficulties on icy runways." On the other hand, he said, the Hunter is remarkably easy to land on those icy runways. Cockpit demisting could be better, he thought, and although the high-speed effectiveness of the tailplane had improved a great deal since the aircraft was given the flying tail he "still felt he wouldn't mind having it even more efficient."

At F 8 Barkaby Major Gerry Dyrssen had this to say: "The Hunter is the nicest aircraft we have had. It is easy to fly, and the training has up to the present been accomplished 100 per cent free from severe troubles due to the pilot handling. . . . I want to mention that we have never had an accidental spin in spite of the fact that the pilots really have taken the maximum out of the aircraft. The Hunter is very kind and 'says when.' Instrumention is good and instrument-flying qualities are excellent. It is remarkable that such an advanced aircraft has such good low speed qualities. It has full control efficiency even at lowest speed. Low-level navigation is easy, even with a cruising speed of 900 km/hr (560 m.p.h.) and we seldom miss the target by more than a few seconds. The time for refuelling and re-arming is remarkably short, and the time from 'scramble' till airborne is shorter than with previous aircraft—mainly due to the liquid-starting system. . . . Our only real problem with the aircraft is keeping all the electronic equipment working—a problem which I believe we share with other fighter units."

A brisk impression of a pair of Hunters (Rolls-Royce Avon turbojet) getting airborne somewhere in Sweden

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

British Private Flying

IN his splendid article on the future of British private flying [January 30] Mr. D. B. Brown did just miss, or perhaps not make enough of, one important point.

The potential world market for light aircraft is enormous, particularly in countries where communications are poor. This demand has been a long time growing, but it is now likely to move with increasing rapidity.

We in this country are fully equipped to answer the demand, but our manufacturers must have a reasonably settled home market before they can produce types suitable for export.

As long ago as 1926 we were leading the world in these same private aeroplanes, but now we have fallen badly behind our chief competitors, France and America. In order to catch up it will be necessary to provide real and positive encouragement for the private flying movement in this country so that a market may be created here which will enable the manufacturers to produce and test suitable types of light aircraft for export.

Claygate, Surrey. NORMAN JONES.

THE connection between your magazine and the Royal Aero Club has always been close—as witness the sub-title on your leader page—and it has been with great interest and pleasure that we have noted the increasing evidence, in your pages, of *Flight's* growing concern over the perils that now beset light aviation.

May we thank you, on behalf of our members and of private flying in general, for the space that you have provided, and the concern that you have shown, for the unfortunate practitioners of that art? It is comforting for us to know, in our fight for the rights of private pilots, that your pages are so readily available to our cause. J. H. BLAKE,

London, W.1. Press Officer, the Royal Aero Club.

Decca and Vortac

FROM articles in the January 23 and 30 issues of *Flight* it is obvious that the M.T.C.A. have done all within their power to demonstrate the obvious superiority in all respects of the Decca navigational-aid systems over Vortac. We can now only hope that sense will be brought to prevail over prejudice at the forthcoming conference in Montreal. I have little doubt that the U.K. delegates will be able to accomplish this, for who but the most incompetent of authorities would be so stupid as to allow themselves to become entangled with the "rho theta point-source concept" to such an extent that they may well find that they are courting financial and possibly physical disaster?

It is encouraging to note that the Decca systems have not only been vastly improved since their sensational conception but that they are still capable of embracing further extremely useful developments. There is, however, one small and simple detail which may have been overlooked, the consequences of which do not bear contemplation. It leads one to imagine a headline in the daily papers—"Airliner reported missing over the Atlantic. Believed to have run out of ink."

Esher, Surrey. G. K. PALMER.

[Pessimists need not worry. The scribing unit of the Decca/Dectra Flight Log is a tiny plastic cartridge device which can be changed in a matter of seconds without interrupting the plotting process. Spare units are always carried—Ed.]

K.L.M. and Singapore

IN your issue of January 23, under the heading "Air Agreements Under Review—1," you have much to say in defence of the British point of view with regard to K.L.M.'s landing rights in Singapore. May I now, as a Dutchman, say something in defence of the Dutch point of view?

We in the Netherlands are, and have always been, promotors of a complete freedom in the air. You know what this means. It means that any airline is entitled to fly scheduled services to every place it desires. In practice it means that an airline of country A may fly to any place in country B, while an airline in country B has the same rights regarding any place in country A. Thus both countries give each other's airlines complete freedom within their respective territories.

The ideal situation would be that this freedom of the air be officially recognized by all countries or at least by a large part of them. They could do so by signing a multilateral agreement giving to all airlines of the countries concerned complete freedom to operate scheduled services to all other countries having signed the agreement, and to as many places as they desire.

This idea was several times promoted by Dutch delegations at I.C.A.O. congresses but always rejected in favour of the system of bilateral agreements now existing. But in the eyes of everybody wishing to give air transport its proper place this system must be seen as a thing of the past. Countries tend too much to weigh against one another the rights allotted reciprocally in such an agreement, wishing to give away not more than they receive themselves.

One must, however, understand that in many cases this not only is an injustice but that it also holds back the proper development of air transport. Small countries, by their very nature, cannot offer as much to their large brothers as the latter have to offer them. Consequently a small country with a large airline, like the Netherlands, is always at a disadvantage when such agreements are discussed with large countries. The expansion of an airline like K.L.M. is thus often hampered by the fact that no suitable agreement can be concluded because other governments only wish to give as many rights to the Dutch company as they can get for their own airlines on Dutch territory. Consequently the very justifiable desire of K.L.M. to expand its activities is thwarted by political considerations.

In addition there is the (usually unfounded) fear of too-great rivalry. Both the U.S. and the U.K. governments have, in the recent past, several times been urged by their respective airlines to deny any further concessions to the Dutch company because they fear losing too much territory to the Flying Dutchmen. But wouldn't it be much wiser to meet such rivalry by improving on the quality of one's own services?

To take the particular case of Singapore as an example: does B.O.A.C. fear losing a great many passengers to K.L.M. if an ample concession is granted to the Dutch company? If this proves to be so would this not be a proof for B.O.A.C. that they are losing ground because their services are inferior to those of their competitors? In that case it would be much better to take steps in order to improve one's own services and in this way regain the lost territory than call on one's government to restrict the rights of the rival airline.

Finally, one should not forget that it is in the interest of the passenger that the best service is given to him. This service will certainly be of a higher standard when the passenger has the choice among several competing airlines than when he only can use the single airline that has, in its position as a "chosen instrument," by far the largest part of the market.

So don't be too narrow-minded. Give your rival a fair chance and prove that you can match him.

Leiden, Holland. B. VAN DER KLAAUW.

[We return to this topic in a leading article in this issue—Ed.]

FORTHCOMING EVENTS

Feb. 13. R.Ae.S.: Presidential Reception.
Feb. 13. Plymouth Aero Club: Annual Dinner Dance.
Feb. 17. R.Ae.S.: "Engine Starting Systems," by R. H. Woodall.
Feb. 18. Aircraft Recognition Society: Talk by Peter Masefield (at Royal Aeronautical Society)
Feb. 18. Kronfeld Club: Film of 1956 Gliding Championships.
Feb. 19. R.Ae.S. Guided Flight Section: "Theoretical Studies of Guided Missile Systems," by E. G. C. Burt.
Feb. 20. Avro 504 Club: Annual Reunion, Londonderry House.
Feb. 23-24. Canadian Aeronautical Institute: Special Anniversary Meeting, Queen Elizabeth, Montreal.
Feb. 24. R.Ae.S.: "Flight Development of Aircraft before and during Operation," by Dr. A. E. Russell, C. Abell and Dr. E. Warlow-Davies.
Feb. 25. Aerodrome Owners Association: a.g.m. and Annual Dinner, London.
Feb. 25. Kronfeld Club: "Some Medical Aspects of High-speed and High-Altitude Flight," by Dr. R. Wombeek.
Mar. 5. R.Ae.S. (Main Lecture, at London Airport Branch): First Fairey Memorial Lecture, "Sir Richard Fairey—an appreciation," by G. W. Hall.
Mar. 6. Helicopter Association: "The Place of the Helicopter in a Modern Army," by Lt-Col. P. W. Mead.
Mar. 7. Helicopter Association (Regional Lecture, at Yeovil): "Helicopter Activities in the Royal Navy," by Lt-Cdr. J. S. Sproule.
Mar. 7. British Interplanetary Society: "Radio Communications with a Space Probe," by Dr. W. T. Blackband.
Mar. 10. R.Ae.S.: "Water and Ice in the Atmosphere," by R. F. Jones.
Mar. 10. Institute of Navigation: Public Lecture on Transatlantic Balloon Flight, by crew of "The Small World," Royal Festival Hall, London.
Mar. 12. R.Ae.S.: 12th Louis Blériot Lecture, "The Nord Griffon; and Turbo-ramjet Power," by M. l'Ing. Gen. de l'Air Noël Daum.
Mar. 19. R.Ae.S. Guided Flight Section: "Long Range Missiles," by E. C. Cornford.

R.Ae.S. Branch Fixtures (to Feb. 20): Feb. 16, *Henlow*, student members papers. Feb. 18, *Southampton*, "Rockets and Interplanetary Flight," by W. N. Neat; *Weybridge*, "Aircraft Carriers," by J. C. Lawrence. Feb. 19, *Bristol* (Junior Committee), "Cosmic Radiation," by Prof. C. F. Powell.

THE INDUSTRY

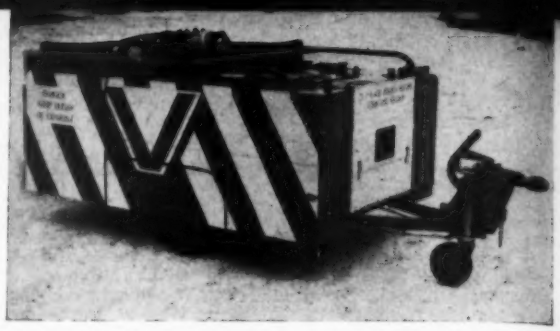
The Dowty-Rotol Deal

THE Dowty Group has given shareholders preliminary details of its plans to raise £3,500,000 to pay for the intended acquisition of Rotol Ltd. The Group is to offer 2,400,000 new ten-shilling shares as a rights issue of one share for every two shares held, the price to be decided later. Authorized capital is to be increased by £1m to £4m. It was announced last December (see *Flight* for Dec. 26) that the Bristol Aeroplane Co. Ltd. and Rolls-Royce Ltd. had agreed to sell to the Dowty Group their interests in Rotol.

Super Fuellers

REFUELLERS of 10,000 gal capacity—about three times bigger than the average tanker in use at airports—are being built for Air BP, the British Petroleum Company's aviation service. Two of these "Yorkshire" refuellers are on order; one is being built by Thompson Bros. (Bilston) Ltd. and the other by Saunders-Roe (Anglesey) Ltd. They should be in service this year at Continental airports where hydrant systems cannot be installed until more experience has been gained with big jet airliners.

Using under-wing refuelling, these super-fuellers will be able to deliver the 18,000-odd gal required by an aircraft of this type in about 15 min. The vehicles will be of ten-wheel semi-trailer construction, with a diesel engine to power the chassis and pumps. The latter will be situated on the forward section of the vehicle, immediately behind the driver's cab.



The "V" on this low-pressure air starting unit denotes that it is intended for service with R.A.F. V-bombers; it is one of an order being executed by Blackburn, and follows others for the Royal Navy and R.C.A.F. Powered by a Blackburn gas turbine, this type of starter is also causing interest among operators of jet airliners; it is already serving Boeing 707s at London Airport

M.o.S. to G.E.C.

FORMERLY Director of Electronics Research and Development (Air) at the Ministry of Supply, A. Cdre. C. A. Bell has joined the staff of the Electronics Division of the General Electric Co. Ltd.

Prior to taking up his M.o.S. post in 1954 he held several R.A.F. appointments in the research and development field; and during the war, as a member of the British Air Commission in Washington, he was responsible for the radio equipment of American aircraft for the R.A.F. He was also associated with A. Cdre. Leedham in the introduction of V.H.F. communications and some of the earliest airborne radars.

In Brief

Mr. J. E. Pateman, A.M.I.E., joint assistant general manager (guided flight), Elliott Brothers (London) Ltd., has moved from Borehamwood to the company's Rochester factory.

* * *

An Austinlite cyclic switch, manufactured by the lighthouse equipment engineers Stone-Chance Ltd. (a member of Stone-Platt Industries), is fitted to the tail unit of the Vickers Vanguard to operate the Napier Spraymat de-icing system.

* * *

Mr. F. L. Gibson, who since joining Wolf Electric Tools Ltd. eight years ago has held the positions of technical representative and divisional executive, has recently been appointed sales manager for the home market.

* * *

Mr. R. J. Mitchell, M.B.E., P.Eng., A.M.I.E.E., has been appointed commercial manager of the Decca Navigator Co. Ltd. in succession to Mr. H. G. Hawker, who was recently appointed a director. Mr. Mitchell, a Canadian, has since joining Decca in 1955 been the company's representative in Canada and closely concerned with the development of the Decca Navigator System in that country. He is a graduate of the R.A.F. Staff College and held a number of R.A.F. staff appointments.

* * *

Mr. F. C. Lunnon, assistant engineer-in-chief of Marconi's Wireless Telegraph Co. Ltd. since 1951, has retired after a career with the company extending over 47 years and interrupted only by R.N.V.R. service in the First World War. His early years with Marconi were spent at the two stations of its Transatlantic Service (Clifden in Ireland and Glace Bay, N.S.); from 1936 to 1946, when he became development manager, he was in charge of the Writtle development establishment; and since 1953 he has been responsible for administering the company's installation services.

* * *

Illustrated here is a recent development by Autoset (Production) Ltd., of Birmingham 18, known for many years as manufacturers of general- and special-purpose castors. It is a one-ton-capacity castor with a Ferodo-lined expanding brake (operated by a control rod passing down through the pivot spindle, and capable of being locked-on) and provision for directional locking. The latter is achieved by a spring-loaded plunger designed to engage a series of holes equally spaced round a circular plate in the fork-head and permitting a choice of eight directional settings. With a solid rubber tyre (which may be of anti-static material if required) dynamic load capacity is 20 cwt; with

The new Autoset castor

Mr. E. Chatterton, designer of the Nomad and Deltic engines, informs us that he has now relinquished his position as chief engineer of the Piston Engine Division of D. Napier and Son Ltd.

* * *

Expandite Ltd., well-known manufacturers of sealing compounds, jointing and waterproofing materials and anti-corrosive treatments, celebrate their silver jubilee on February 24. The company was founded in 1934 by Mr. Bertram Watson, who is today the chairman and managing director.

* * *

Mr. R. W. Cantello has been appointed managing director of Airwork Services Ltd. and Dishley Engineering Ltd. He was formerly general manager of both companies and in that capacity has been succeeded at Airwork Services by Mr. J. H. Hopkins and at Dishley Engineering by Mr. J. S. Reid. The commercial manager of Airwork Services is Mr. D. F. Burmby, who is based at Airwork House, 35 Piccadilly, London, W.1.

S/L. W. F. G. (Bill) Withers, M.B.E., who has been appointed general sales manager of Aero Controls Ltd., having retired from the R.A.F. last month after 30 years' service. He joined in 1929 as a Halton apprentice, subsequently trained as a pilot, then transferred to the technical branch in 1940. After a wide variety of E.O. posts in the U.K. and overseas he was seconded to the M.o.S. His last appointment before leaving the R.A.F. was at Coastal Command headquarters

It has recently been learned that the pedal-driven height-adjusting propellers of the transatlantic balloon *The Small World* were designed and manufactured by the Airscrew Co. and Jicwood Ltd. Made of resin-bonded white seraya, a high-strength material used for wooden fan blades, the blades were of a form similar to that used in a new range of axial-flow metal fans shortly to be introduced by the Airscrew Co. for industrial applications.

* * *

Mr. F. J. Fuell, chief designer, Hydraulics Division, Fairey Aviation Co. Ltd., writes to say that a recent reference on this page to a Canadian-manufactured filter fitted in the hydraulic system of the CF-100 implied that this particular make of filter is used in all the CF-100 powered-control circuits. These controls, explains Mr. Fuell, were designed by Fairey; and at their recommendation an absolute cut-off 5-micron filter, also of Fairey design, was later fitted in the circuit. At the request of the R.C.A.F., however, it was arranged that some 25 per cent of the filters should be made in Canada "so that, as the R.C.A.F. put it, there would be an organization in Canada manufacturing filters similar to the Fairey unit."

Photographed last week at Hong Kong, in the shade of Lion Rock, and still bearing its B.O.A.C. name "Athena," is the Argonaut G-ALHT recently bought from the Corporation by Overseas Aviation of Jersey. It was on a charter flight from the U.K.

"Flight" photograph

AIR COMMERCE

THE NEW YORK TRAGEDY

A LOCKHEED Electra of American Airlines crashed into New York's East River at midnight on February 3 while attempting to land in fog and rain at La Guardia Airport. Of the 73 people on board only eight were rescued alive. These included the co-pilot, who may be able to throw some light on the puzzling circumstances of the accident.

The Electra, which had inaugurated American Airlines' turbo-prop services only 11 days previously, was on a scheduled service from Chicago. Its flight was reportedly routine for two hours, but there seems to be some mystery as to why its first contact with the La Guardia approach system came three-quarters of an hour after its La Guardia E.T.A. However, at 2354 New York time, the commander, Capt. Albert H. De Witt (who had flown with American Airlines for 30 years) requested a clearance for an I.L.S. approach. Visibility was reported as two miles with a ceiling of 300-400ft. Conditions were subsequently described by a C.A.B. official as "unpleasant though thoroughly safe." The approach was reportedly from the north east, which would suggest the use of the 5,000ft runway 04/22. This runway is reported to have no glide-path markers for approaches from the north east. It is apparent that the Electra undershot; the point of impact in the East River was close to Rikers Island, which is to the right of the approach from the north east.

BOEING 707 ESCAPE

A PAN AMERICAN Boeing 707 en route from Paris to New York on February 3 experienced what was described by a spokesman for the airline as a "near emergency." As a result, it is reported, of a fault in the automatic pilot, the aircraft—which was carrying 124 passengers—descended from 30,000ft to 6,000ft, experiencing "high-speed buffeting" causing "a small piece of non-structural material used for streamlining" to break away.

The incident took place 500 miles east of Gander, whither the aircraft was subsequently flown manually. The passengers—none of whom suffered injury despite some negative g—were transferred to another aircraft. There was no panic during the incident.

Skyways and B.O.A.C. are here seen relaxing for a few moments in the soft sunshine of the Bahamas. On the left is Mr. Eric Rylands of Skyways, on the right Sir George Cribbett of B.O.A.C. They were discussing Bahamas Airways, 80 per cent of which is now owned by Mr. Rylands and by Mr. David Brown, at whose Nassau home this picture was taken. B.O.A.C. were formerly sole owners of Bahamas Airways

JAPAN'S NEW AIRLINER

IN Tokyo last week *Flight's* representative heard about progress with the YS-11, the twin Rolls-Royce Dart RDa.10-powered airliner first announced a year ago. A full scale mock-up has been built at the Sugita (Yokohama) factory of the Nippon Hikoki K.K., at a cost of about £50,000. "Basic design work" has been completed, under a budget for 1958 of about £300,000.

The YS-11, according to the Japanese journal *Aireview*, is the final type to come out of a design committee headed by Dr. Hidemasa Kimura, chief designer of the Yusoki Sekkei Kenkyu Kyokai (Transport Aircraft Designing Research Association), which originally announced three versions. A three-view drawing of the finalized YS-11 will appear in next week's issue.

For twin-Dart power (the RDa.10 develops 2,655 e.h.p.) the YS-11 appears likely to be a formidable uplifter of payload: a seating capacity of 60-70 passengers is proposed. (The fuselage diameter is about 10ft.) It is, however, intended for very short ranges, its optimum design stage-length being quoted as 200-600 miles.

The designers of the YS-11 estimate a demand for 150 aircraft in the period 1960-1966, including an export market for 40.

Financing of production will be shared by the government (to the tune of about £2.5m) and private interests (about £0.75m) which will comprise a consortium known as The Nippon Ryokakuki Seizo Kaisha (Japan Air Transport Manufacturing Company). The firms participating will be: Mitsubishi Heavy Industries, Kawasaki Aircraft, Fuji Heavy Industries, Nippon Hikoki (who have built the mock-up), Shin Meiwa Kogyo, and Showa Hikoki. No doubt this formidable combine—who are making an investment in the YS-11 averaging only £12,500 apiece—will represent the renascent Japanese aircraft industry, which by the latter sixties could conceivably—if the vigour of Japanese shipyards is a yardstick—become a strong government-supported challenger of the British aircraft industry. The new combine will be formed this year.

The prospect of early orders for the YS-11 (which incidentally will be the third foreign-built airliner to be Rolls-Royce Dart-powered) is suggested by an "unofficial" statement from the Japanese National Defence Agency to the effect that the aircraft is regarded as a possible C-46 replacement. The NDA has 36 C-46s, of which only 15 are said to be serviceable. A recent request for a further 16 for 1959 delivery has been turned down.

YS-11. Span, 105ft; length, 88ft; wing area, 1,022 sq ft; aspect ratio, 10.8; take-off weight, 49,600 lb.

FOUR MEN IN A COCKPIT

PANAM and the Air Line Pilots Association have at last reached agreement on the vexed subject of pilot remuneration. Both sides appear to have compromised in order to settle this nine-month dispute. A.L.P.A. have agreed that a senior captain flying a PanAm 707 or DC-8 will receive an annual salary from $29,000 (£10,340). Maximum flying time under the contract will be 80 hr per month. The original PanAm offer stipulated $28,589 and 85 hr. According to the airline, A.L.P.A.'s original demand was for conditions that would bring a senior jet pilot's remuneration to $45,000 annually.

The airline has gone much further towards satisfying A.L.P.A.'s demands in regard to crewing arrangements: a third pilot will now be carried on all jet services, his nominal capacity being that of navigator. At one time A.L.P.A. had sought to displace flight engineers, their place being taken by pilots trained (at PanAm expense) as qualified engineers. The airline pointed out that the flight engineers' contract was not due to expire until June 1960. When the future of the flight engineers comes up for review PanAm will be in a stronger position to evaluate the technical considerations involved.

At Wisley on February 5, Col. A. Soriano, Philippine Air Lines president, arrived in the first of their five P. & W.-powered Twin Pioneers to inspect the Vanguard. With Col. Soriano are (l. to r.) Mr. J. B. Armstrong, Vickers-Armstrongs; Mr. Clair Waterbury, P.A.L. representative in London; and Mr. R. C. Handasyde, V-A. sales manager

AIR COMMERCE . . .

B.O.A.C. INQUIRY CRITICIZED

A VOTE of 13 hands to 11 by the trade-union side of the National Joint Council for Civil Air Transport, turning down the findings of Professor Jack's court of inquiry as "not contributing in any way to a solution of the [industry's] difficulties" seems to have been made more in the nature of a protest than as an outright rejection. The resolution implies a rising of union hackles at any attack on the functions of shop stewards; but the Amalgamated Engineering Union—one of the sponsors of the resolution—noted that sections of the report could be discussed.

The most violent reactions to this vote have come from within the union side of the Council itself; the secretary, Mr. Jim Matthews, said that he was perfectly certain that the report had been rejected because of criticism of certain individuals—particularly the chairman (Mr. Ian Mikardo, M.P.) and he suggested that this might mean the break-up of the trade-union side of the Council "as we know it." He then announced his intention of resigning.

SWISSAIR FORGE AHEAD

NO European airline weathered last year's economic depression as comfortably as did Swissair. Over a period when rivals rejoiced at the mere appearance of a plus sign, the Swiss national airline experienced an increase in traffic of 18 per cent.

Load ton-miles increased to 84m, but capacity ton-miles rose at an even faster rate to 140m (load-factor dropped from 62 to 60 per cent). These figures show that Swissair has doubled in size over the past three years, most of this expansion coming from the intercontinental routes. During that time the number of staff employed rose by only 69 per cent from 3,223 to 5,429.

Average utilization over the whole fleet was of the order of 2,500 hr. The eleven Convairs, operating exclusively on the short-haul, seasonal European routes, averaged slightly over seven hours flying per day, while the DC-7Cs reached the impressive daily utilization rate of 11 hr.

JACK FRYE

IT is with great regret that *Flight* learns of the death of Mr. Jack Frye in a car accident on January 28 at Tucson, Arizona. Jack Frye, who was 54, was one of the big men in American aviation. A friend has described him as "a flier, a businessman, and a visionary." His flying career, like that of many other Americans in leading aviation positions today, began with barnstorming; and with two other such fliers, Paul Richter and Walter Hamilton, he founded Standard Airlines in 1927, operating between Los Angeles and Phoenix. This was one of the companies which later, in 1934, merged into T.W.A.

He became the first president of T.W.A. in 1934, when he was only 29, and he held this post until 1947. He was a prime mover behind the design and development of the Douglas DC-2, and he bought this aircraft—and the other famous DCs which followed it—for operation on T.W.A.'s routes. His name is also linked with the Lockheed Constellation, which T.W.A. were, in 1940, the first to order. In other words, Jack Frye helped to launch both of the world's most famous airliners.

In 1955 he founded the Frye Corporation, with the object of devoting his air transport operating and engineering experience to a project which he called the Safari, an interesting DC-3 replacement type powered by four Wright piston engines. Despite the promise of firm orders the project was dropped early in 1957 owing to lack of sufficient finance.

FOLLOW MY LEADER

EAGLE'S announcement of their low-fare project for British cabotage routes aroused immediate interest as to the course to be adopted by the two independents—Airwork and Hunting-Clan—originally responsible in 1952 for developing the colonial-coach class services to Africa.

After rather more than a month's silence—a period during which there were reports of opposition by these companies to the Eagle project—Airwork and Hunting-Clan have now revealed their own scheme for extending low-fare services. This scheme is virtually a replica of that put forward by Eagle. Most colonial territories of any air transport consequence are included, proposed fares corresponding almost exactly with those quoted by Eagle.

This coincidence is, of course, no accident. It appears to be a phenomenon unusual to the airline industry but common elsewhere—price leadership. Once a new low price-level has been initiated cost considerations militate against undercutting while competitive pressures prevent overpricing. The possibility that the various parties in the present instance got together is most remote—and is in any case denied by the airlines concerned.

When the A.T.A.C. come to consider these applications, the experience of the U.S. supplemental carriers might well be borne in mind. The C.A.B. has granted permission to selected non-scheduled airlines to operate routes on a low-frequency, low-fare basis. By keeping frequency at a low level, and relating it to the total volume of traffic, it has been possible to avoid diversion of passengers away from the higher-fare services, or at least to keep diversion down to insignificant proportions.

The two corporations have plans to introduce economy-class services on most routes to which the Eagle/Airwork/Hunting-Clan applications refer. But although seating standards in either case conform to the 34in pattern, the independents—thanks to lower operating costs and higher expected load-factors—are offering rates well below the economy-class level.

Noisy objection to the low-fare applications is likely to harm the reputation of the corporations in the eyes of the public. A negative Ministerial decision would also damage their reputation should the affair become a popular issue.

But two political considerations will weigh against the independents: on the home front, a Socialist Government would hardly enthuse over the proposed services; and abroad, the emancipation of colonial territories (particularly Nigeria, Southern Rhodesia and the Caribbean) will result in a reduction of cabotage privileges.

TEN ELECTRAS A MONTH

LOCKHEED plan to deliver no fewer than 46 Electras during the first six months of this year, production rising to a peak in June when ten aircraft will be delivered.

Last year saw the first eleven Electras being delivered to Eastern and to American. A single aircraft was also taken over by Allison. Further deliveries will continue within the first half of the year to Eastern and American and to three other U.S. domestic trunk carriers—Braniff, National and Western. Three foreign airlines will also be receiving Electras within the next few months: Cathay Pacific and Ansett-A.N.A. will accept their first aircraft in March while T.A.A. will take delivery in June. A sequel to American Airlines' Electra accident is the imposition by the F.A.A. on Electra landings of a minimum ceiling of 1,000ft and one-mile forward visibility by day and two miles by night.

Continental Airlines' striking livery—the most distinctive feature of which might be called the blue-faced look—is here applied to the first of their four Boeing 707-120s, rolled out on January 29

ALTIMETER CHANGE-OVER

FATHERED by necessity, the altimeter with three pointers seems at last to be nearing the end of its days, at least in its present form. Whilst it cannot yet be said that the existing type of altimeter was to blame in two recent British accidents (the inquiry reports of which have yet to be published), this current method of height presentation, with three sizes of pointer moving over a common scale, is under grave suspicion, and it is likely that a Notam will shortly be published urging or demanding a modified design of altitude presentation in civil transports by later this year, probably at the end of September.

The problem of a replacement instrument is not an easy one to solve, particularly in view of the high turn-over of instruments that would be required to eliminate this hazard.

The chief technical difficulty to be overcome is, very broadly, that of indicating altitude to relatively fine limits: the present instrument shows height in divisions of tens of thousands, thousands and hundreds of feet, with a sub-division on the scale to read to 50ft and, by interpolation, to considerably less. It is not possible to compromise much on these divisions; and the three-pointer instrument is quite easy to misinterpret, because the pointers must overlap as they move around the scale. In pressure altimeters, operated by a barometric capsule, a "click-over" action which could be used for a positive (rather than progressive) veeder counter presentation of, say, the 10,000ft scale is not possible. This is a serious deficiency and, short of adopting servo-operated instruments—probably also part of the eventual, more complex answer to altimeter accuracy difficulties, appears to rule out a modification of existing instruments in this way.

New forms of presentation are, however, being actively studied by the instrument manufacturers and considered by the Corporations. Working with Kelvin and Hughes, B.E.A. have recently examined several new designs and put forward modifications after evaluation in a link trainer and in a Viscount 802.

The basis of one new instrument is deletion of the small central 10,000ft pointer in favour of a pointer and bar moving outside the scale on the dial. The position of this pointer is emphasized by a trailing radial bar indicating the segment traversed by the bar and pointer. The thousand-feet pointer is reduced in size. During descent the length of the trailing bar will progressively diminish, but in one design at least, a positive indication is made of low altitude. This consists of a cut-out in the dial between the figures 7 and 8 behind which is a rotating disc distinctively hatched in black and white. This hatched indicator first appears at about 15,000ft and the hatched segment will progressively increase in size as altitude is reduced.

Interim altimeter with revised scale, pointers and low-altitude warning

Much has already been said and written about all-veeder-counter or ribbon-scale altimeters, and active development is in progress. Many pilots and engineers believe that this is the ultimate answer in altimeter presentation, but it seems very unlikely that such a design can be adopted with a pressure-capsule instrument. Meanwhile, problems of obtaining increased high-altitude accuracy remain to be solved, and the modified pressure instrument likely to be demanded by A.R.B. may prove to be only an interim step in providing air transport with a more complex, but more accurate and easy-to-read instrument deriving information by air data computation and presenting it in a completely unambiguous manner.

FARES: B.O.A.C. LOOKS FORWARD

A CURIOUS feature of the international fare controversy that now boils up every autumn is that the contestants are prevented from arguing the case in public. This state of affairs is partly dictated by internal requirements—primarily, the need to retain flexibility in negotiation by being able to change position without loss of face. But the arrangement is also imposed from without as a condition of I.A.T.A. membership: a very heavy fine is likely to be levied on those who tell tales out of school.

Various airlines react differently to this situation. The Brer Rabbits keep very quiet, preferring to avoid any possible danger. Others adapt the "bank-rate technique" and have heart-to-heart discussions with "reliable" members of the outside world, but impress on their listeners the strictly confidential nature of these briefings. A third group takes the opportunity to spread insinuations about the anti-social behaviour of other airlines which hold opposing views.

B.O.A.C. are one of those airlines which rightly believe in avoiding any discussion on subjects which are *sub judice*. For this reason, very little information has been available on the basis for the Corporation's fare policy. The eve of the I.A.T.A. fares conference at Paris provides an appropriate occasion to analyse the main ingredients of this policy.

Three features appear prominent in B.O.A.C.'s present thinking on fares—first, cheaper fares must be reduced wherever possible; second, no single class of travel must subsidize other classes; and, third, there is no economic justification at the present time for distinguishing farewise between jets and non-jets. Taking each of these in turn, the contention that B.O.A.C. belongs to the low-fare school may raise quite a few eyebrows; but it is nevertheless true. B.O.A.C. was, for instance, the only airline that wished to see an immediate extension of economy-class services to the African and Eastern routes. Others would have been happy to see these fares come into effect in these areas in 1960 or 1961—but not before. This is, of course, a break with previous tradition. B.O.A.C., under an earlier top management, opposed tourist-class services in 1951. But that was a time when the Corporation was severely handicapped by shortage of available capacity.

Equally strongly held is the belief that no single class of traveller should subsidize another. B.O.A.C. contend that in recent years the low-fare passenger has indeed been subsidizing the high-fare passenger. In relation both to the relative costs of providing low-fare and high-fare accommodation, and to the ability of various classes of traffic to pay for air travel, the expense-account travellers have been paying less than they should. The main extra cost of carrying first-class traffic does not arise from the culinary embellishments involved but in the lavish amount of floor space allowed to each passenger. In theory any aircraft operated on a given route at a given load-factor should show the same passenger revenue regard'ess of the class of accommodation offered. In practice, the least revenue is available from first-class services. If fares for the expense-account traveller were raised to the economic level, then airlines could afford a corresponding reduction in the lower fare levels.

Possibly the most firmly held conviction is that no worthy economic case has yet been made for a fare differential based on aircraft type. B.O.A.C. would doubtless emphasize that this is not a case of "have versus have not"—they are in the position of simultaneously belonging to both camps. They are also in the unique position of having up-to-date operating experience of the three main types of airliner—piston, turboprop and turbojet. This experience has evidently convinced them that the last of these is the most efficient machine in terms of economics. Direct operating cost per seat-mile is obviously not the only factor in the economic equation—load factor, productivity and reliability have each to be taken into account. Considering these factors together B.O.A.C. are apparently convinced that in a few years' time, say 1961, a discount on jets is likely to be more appropriate than a premium.

There remains the question whether a short-term differential in favour of slower non-jet services is advisable. B.O.A.C. has opposed such a scheme on these grounds: first, there are strong administrative reasons why a complicated international arrangement should not be negotiated and put into effect if the contract is to be short-lived; second, there would be widespread diversion of traffic to the lower-fare services; and, third, no way could be found *in practice* to prevent carriers anxious to increase their share of the traffic from offering lower fares on the faster services. The domestic experience of American and National in respect of setting a jet surcharge is unlikely to apply to the international routes. These carriers sought temporary C.A.B. permission for their action on the grounds of improved standards of passenger service (particularly, more seat space, and better cabin service). On this understanding the Board have approved a temporary surcharge. But as regards international services, no changes in standards of service are being effected. Also, the novelty of international jet travel will have worn off by the time a fare surcharge could come into effect.

A more morbid consideration is the possibility of the new jets becoming involved in some disaster. This could well divert traffic to more conventional types of aircraft. In such a case the jet surcharge would be an unjustifiable imposition. Yet the mechanism of fare setting is such that a fundamental alteration in the attraction of any particular type cannot immediately be accompanied by an appropriate change in the level of fares.

A final aspect of B.O.A.C.'s thinking is that their policy does not appear to be affected by the fear of excess capacity. Other airlines have argued that only by charging lower fares for slower services will it be possible to create sufficient traffic to ensure employment of current fleets and of aircraft on order. The Corporation do not conceal their belief that past equipment difficulties have led to their now carrying an inappropriately small share of long-haul traffic. To regain their rightful share will call for full employment of all their aircraft, and for energetic penetration of the low-fare market.

J. C. S.

The life-sized dragon on the nose of this DC-6B is the emblem of C.A.T., Nationalist China's airline, a note on which appears below. This picture was taken at Tokyo last week

"Flight" photograph

AIR COMMERCE . . .

NATIONALIST CHINA'S AIRLINE

DURING *Flight's* recent Comet 4 tour to the Far East a few brief impressions were gained of Nationalist China's airline C.A.T. (Civil Air Transport). At Tokyo's Haneda Airport was C.A.T.'s new DC-6B (picture above) magnificently liveried in yellow, orange and black, and bearing the airline's dragon *motif* on its nose—an insignia exclusive to this one aircraft of the C.A.T. fleet of DC-4s, C-46s and DC-3s. This aircraft, which flies mixed-class (first and tourist) services, operates the four-times-weekly "Mandarin Flight" linking Taipei, capital of Formosa, with Hong Kong, Manila, Okinawa and Tokyo (Sundays); Bangkok and Hong Kong (Tuesdays); Manila (Tuesdays); and Bangkok, Hong Kong, Okinawa, Tokyo and Seoul (Fridays). At C.A.T.'s engineering base at Tainan, which is also a Chinese Air Force base, an official of the airline said that the C.A.T. fleet now comprises a total of 46 aircraft, including one DC-6B, "more than 20" C-46s, three DC-4s, and three DC-3s. Domestic services only are operated from Tainan, whose airport terminal buildings appeared to the B.O.A.C. Comet 4 transit passengers rather reminiscent of those at Blackbushe.

C.A.T.'s main activity at Tainan appeared to be repair and overhaul work—not only for themselves, but for the Chinese Nationalist Air Force also. A fair number of Sabres, together with their J-47 jet engines—were being overhauled and test-flown, and C.A.T. and military transports, including DC-4s and C-46s, were undergoing major overhauls out-of-doors in the warm sunshine. The general impression of C.A.T. to the casual observer was of bustle and efficiency.

Among the aircraft seen at Tainan bearing the blue and white roundels and barred tails of the Chinese Nationalist Air Force were Mitchells, C-119s and T-33s. A link with the de Havilland Comet 4 of B.O.A.C. was provided by a visiting de Havilland L.20 Beaver of the U.S.A.F.

CANADA'S CONTROLLED COMPETITION

ON January 21 the Canadian Minister of Transport, Mr. George Hees, tabled a report on the C.P.A.L. application in the House of Commons in Ottawa. The Minister's comments to the House explained clearly his government's policy (one particularly significant passage we have printed in italics):—

"The investigation of the Air Transport Board and its hearing of the Canadian Pacific Air Lines application was dealt with in regional hearings in Vancouver, Edmonton, Regina, Winnipeg and Moncton between October 6 and October 15, 1958, and in final hearings commencing October 20 and terminating December 3, 1958, in Ottawa; and involved consideration of several dozen briefs and well over a thousand pages of oral evidence.

"The Board found that additional transcontinental air services could not be introduced at this time without major detrimental effect to existing operations, and without economic hardships and possible disadvantages for scheduled airlines, including the applicant. The Board found that the application of C.P.A.L. should be denied *because its expense estimates were computed on an unreasonable added cost basis, with no projection on a fully allocated cost basis; its revenues were estimated without any traffic study; and the schedules for its proposed service appeared to have been based on optimistic block speeds.*

"However, the Board also found that the position of C.P.A.L. as an international air carrier needed strengthening, and it has recommended issuing to the airline a licence to operate a domestic scheduled service from Vancouver to Winnipeg, Toronto and Montreal, to connect their existing international operations. This new service would be limited to one return flight a day, on which domestic as well as international passengers could be carried. It recommended that the adequacy of this arrangement be reviewed again in two years to see whether additional services would then be warranted.

"The Board also recommended that where limited controlled competition would result in improving the position of regional air carriers, this be authorized, and the Board has indicated that it feels it should make an intensive investigation of the position of regional air carriers in this connection.

"I have informed the Air Transport Board that I am prepared to accept their findings in regard to the foregoing. The Board has also recommended that a substantial portion of the government work now being performed by the R.C.A.F. be diverted to commercial air carriers. There is, of course, an obvious requirement that the Department of National Defence maintain a military air transport organization in being. At the same time, military authorities have always recognized their interest in maintaining civil air transport services which can assist them in time of emergency and, indeed, much of the present work of the larger regional air carriers in Canada is in the direct supply of military installations in the north. This particular recommendation of the Air Transport Board will require further careful examination and I propose to consult with my colleague, the Minister of National Defence, about it."

In reply to a question the Minister reminded the House that "last February I made a speech expressing the Government's view on these matters in which I indicated that our policy was that where competition could be economically sound on any particular route we would be in favour of competition being introduced. The policy which has been announced here is in conformity with those views."

"Baggage expediter system" is American Airlines' description of their Electras' baggage loading technique. Four prepacked containers, shaped to fit the hold, and handled mechanically, put an end to old-fashioned "chuck 'em aboard" methods

AIRCRAFT NUISANCE DEBATED

ON January 2, in an adjournment debate, the House of Commons discussed aircraft noise at British airports. Mr. Ronald Bell (Con., Buckinghamshire South) reminded the House that the 1947 Air Navigation Act prevented actions of nuisance being brought against operators. Although the Government promised to keep control over airport noise, in practice it adopted the attitude that "the man on the ground [should] get used to these new noises . . . and put up with them with good grace." Mr. Bell's constituents claimed that the Comet and Caravelle were not causing anything like as much annoyance as those "inventions of the devil," the Boeing 707 and the Tu-104. These last two types were "causing not only noise but actual physical vibration in some of the houses over which they go . . . and are producing a state of near-prostration in some rather sensitive people." Mr. Bell concluded by suggesting that manufacturers and operators would soon find a solution if suitable restrictions were imposed.

Mr. A. Hunter (Lab., Feltham) expressed doubts about the value of noise tests currently being conducted by the Ministry and stressed the need for research and for international co-operation.

The Joint Parliamentary Secretary to the M.T.C.A., Mr. John Hay, opened his reply by defining the principles under-

lying the Ministry's policy towards operating procedures: the burden of noise must not be transferred from one community to another; as many people as possible must be relieved of this burden, and no aircraft types were to be banned from any particular airport. Mr. Hay then referred briefly to the operating restrictions in force: a minimum height of 1,000ft when taking off over built-up areas, and a minimum glide-path of 3 deg on landing. Since mid-November his Ministry had been recording altitudes and noise levels for Boeing 707 and Comet take-offs and had monitored landing procedures through the use of radar.

The M.T.C.A. had already placed various restrictions on ground engine-testing. Earth banks were being erected at London Airport and at Gatwick to reduce the noise coming from maintenance sheds, and airlines were now obliged to fit mufflers to engines being run on the ground. Mr. Hay assured the House that intensive research was already being carried out to reduce noise levels. He referred to the suppressors now fitted to the Comet, and added that the by-pass and ducted fan engines would present less of a problem. (In a subsequent written answer to a question raised by Mr. Hunter on the subject of smoke, Mr. Hay stated that his Ministry was not prepared to request PanAm to refrain from using water/methanol injection on take-off.)

J.A.L. AND THE ROTODYNE

NOTWITHSTANDING present doubts about B.E.A.'s interest in the Rolls-Royce Tyne-powered version of the Rotodyne, Japan Air Lines last week made a positive statement of their intentions. According to a report in the Singapore Sunday newspaper *Tiger Standard* on February 1, Mr. Susumo Saito, J.A.L.'s general sales manager, said that his airline plans to introduce Rotodynes "to carry passengers from airport to city." J.A.L. intended, he said, to "experiment with the Rotodyne first in Tokyo, and if it proves successful we will extend this service to other places also." Mr. Saito was until recently J.A.L.'s district manager in Singapore.

According to a report in the *Daily Mail* last week, the Treasury have been prepared to invest up to £4 million in the Rotodyne during the next three years, though this has presumably been conditional upon B.E.A.'s intentions to order the aircraft.

In a letter to the *Daily Mail* the chairman of B.E.A., Lord Douglas of Kirtleside, has stated that a definite order for Rotodynes cannot be placed by B.E.A. until it is known whether a larger version can be developed and whether the aircraft noise level will be acceptable.

BREVITIES

The I.A.T.A. fares conference is due to re-open in Paris on Monday, February 16.

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American Airlines announce the appointment of Mr. F. C. Wiser as vice-president, operations.

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Swissair and S.A.S. are reported to be considering the operation of services into Rotterdam.

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Schiphol experienced 404 hours of fog last year. The equivalent figure for 1957 was 287 hours.

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Eagle Airways (Bermuda) Ltd. are due to inaugurate a once-weekly service between Bermuda, Baltimore and Washington next month.

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Ansett-A.N.A. are opening a London branch in the near future. Mr. A. C. H. Petherwick, their former manager in South Australia, has been appointed U.K. sales manager.

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I.A.C. have introduced a *janata* (austerity) service at reduced fares between Calcutta and Agartala. If the public response is favourable this class of travel will be extended to other routes.

* * *

Ansett-A.N.A. have revealed plans for helicopter services in Melbourne. The proposed network would link the city centre with the airport and with outlying districts. Fares would be in line with existing taxi fares.

Airwork Services Ltd. have moved from Gatwick to Hurn.

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El Al will place Britannias on their Amsterdam service as from March 28.

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The Austrian Government have granted a loan amounting to 25m schillings (about £342,000) to Austrian Airlines.

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A Caravelle is due to leave for Stockholm at the end of this month to participate in a two-month crew-training course for S.A.S.

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A new airfield has been constructed in the Sibyl valley in New Guinea to facilitate the progress of a Dutch scientific expedition into the Star mountains.

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Pegasus Airlines now have a fleet of three Vikings based at Luton. The airline has applied to operate a scheduled service between Luton and Rotterdam.

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American Airlines will pay Douglas $4\frac{1}{2}$m for converting ten of their DC-7Bs into all-cargo aircraft. Capacity of the DC-7B freighter has been given as $16\frac{1}{2}$ tons.

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A new company—South Airlines—has been formed at Leeds to operate Heron services from Yeadon to Exeter and later to Bournemouth and the Isle of Wight.

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Aero Contractors have applied to the Dutch Ministry of Transport to operate regular helicopter services using Vertol 44s from Schiphol to Amsterdam, Rotterdam and The Hague.

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Last year Aer Lingus passenger traffic exceeded the half-million mark for the first time. The airline's four Viscount 700s will be taken out of service and sold as they become due for check 4s.

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Birmingham City Council have agreed to take over Elmdon Airport from the M.T.C.A. The Ministry are expected to pay for the full cost of providing technical services and for 60 per cent of the £700,000 capital programme covering the next five years.

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Sir George Edwards, Vickers-Armstrongs (Aircraft) managing director, has expressed his belief that Continental will buy more Viscounts. Another prospective Viscount customer is Mr. Arthur Butler, whose request for importing six Caravelles has been refused by the Australian Government.

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An air services agreement between Yugoslavia and the U.K. was completed in London on February 3. B.E.A.'s once-weekly service to Belgrade will now no longer be operated under temporary rights. J.A.T. has received reciprocal rights to operate Belgrade - London via one or more intermediate points.

A rare air-to-air shot of a night-landing by a Super Constellation using the "electronic flash approach system" (EFAS). This "beckoning" lighting has been used for some years at Newark Airport, N.J., and a system made by Sylvania Electric Products of New York is now being installed at Chicago Midway

The first Canadair 540 (CL-66) for the R.C.A.F. being rolled out from the company's Montreal plant prior to its successful initial flight on February 2. The aircraft, which bears the markings of Air Transport Command (to which ten are being delivered), is a developed Convair 440 powered by two Napier Eland 6 turboprops

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Winter Cruise

AN Avro Vulcan of Bomber Command left R.A.F. Finningley last Tuesday for Bermuda to participate in ceremonies marking the 350th anniversary of British colonization. This is the first time a Vulcan has been there. The aircraft, from No. 101 Sqn., is captained by S/L. D. T. Skeen. It has as co-pilot A.V-M. J. G. Davies, Bomber Command S.A.S.O., who is to lecture in the U.S. and Canada. The Vulcan is due to return to Finningley from Toronto next Thursday.

Flying with the Dutchmen

SINCE Tuesday this week No. 800 Sqn., one of the two Fleet Air Arm squadrons which gave displays at last year's Farnborough show, has been on a visit to Holland which is to last until February 25. Equipped with Sea Hawks and commanded by Lt-Cdr. A. A. Fyfe, the squadron is being accommodated at the R.N.N. air station at Valkenburg and during its visit will exercise NATO common operating doctrines with the Royal Netherlands Navy, which has two Sea Hawk squadrons.

Artistic Esteem

A PORTRAIT of Air Marshal Sir Richard Atcherley is to be unveiled and presented to him by the Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, at Flying Training Command headquarters next Wednesday. The painting, which is the work of Mr. Herbert Holt, was commissioned by the officers and students of F.T.C. as a mark of esteem for their Air Officer Commanding-in-Chief. It is to hang in the Mess at Shinfield Park until Sir Richard's retirement from the Service on March 1, when it will be moved to a permanent home in the Hall of Fame at Cranwell, where he was once a cadet and instructor and in 1946 became the College's first post-war Commandant.

Punctual Example

DURING his recent overseas tour the C.A.S. set a splendid example of punctuality. Sir Dermot was only once late, when torrential rain at Gibraltar caused extensive flooding, which necessitated burning-off fuel before landing, because only 1,500 yd of runway was available. On all other occasions on the 22,000-mile tour (some photographs from which are published on page 208) the Canberra B.6 the C.A.S. flew landed within 50 sec of pre-planned time.

Back to Henlow

WHEN A. Cdre. N. C. S. Rutter takes over next Monday as A.O.C. and Commandant of the R.A.F. Technical College, Henlow, he will become the first of the college's former engineering students to have returned there in command. He took a course at Henlow in 1935, after having served as a bomber pilot with squadrons at home and in India. During the war he was in the Far East and his post-war appointments have included that of Senior R.A.F. Officer (for three-and-a-half years) at Cape Canaveral, the U.S.A.F. missile test centre. In 1958 he took the I.D.C. course.

A.V-M. M. H. Dwyer (right), who is on a liaison visit to the United States after taking last year's I.D.C. course, making a tour of the Thor production line at the Santa Monica (Cal) division of Douglas Aircraft Co. On his right is Mr. H. M. Thomas, chief engineer of the Thor project

No. 194 Sqn. Reunion

THIS year's ninth reunion dinner of No. 194 Sqn. (India - Burma - Malaya) will be held at the Royal Horticultural New Hall, Elverton Street, Victoria, London, on Saturday, March 14, at 6.30 for 7.30 p.m. The guest of honour will be Vera Lynn and tickets (18s 6d) can be obtained from the hon. secretary, Douglas Williams, 56 Mottingham Lane, Lee, London, S.E.12 (tel. Lee 1025).

Changes at Biggin

BIGGIN HILL is receiving new tenants following the move of London University Air Squadron to White Waltham last week. Recently the Surrey Flying Club migrated there from Croydon (see Sport and Business, page 225), and later this year the Ground Officers Selection Centre is being transferred from R.A.F. Uxbridge. Early in 1960 two more R.A.F. units are expected to move to Biggin, from Hornchurch—the Aircrew Selection Centre and the Personnel Selection Training School.

Aircraft on Order

SOME information on new aircraft for the R.A.F. and Royal Navy was given by the Minister of Supply in Parliamentary answers last week. He said that deliveries of the twenty Britannias for Transport Command were expected to start in the next two or three months and to be completed in 1960; orders had been placed for the Bristol 192B [sic] and Westland Wessex helicopters for the R.A.F. and Royal Navy respectively. (The Minister's reference to the 192B is curious. Bristol Aircraft say there is no such machine. Presumably Mr. Jones meant the 192.)

IN BRIEF

W/C. W. J. Ryan, who was deputy secretary of the R.A.F. Benevolent Fund from 1945 to 1957, died recently at the age of 75.

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Miss J. Elise Gordon, editor of our associated journal *Nursing Mirror*, left Lyneham on February 3 by Comet of No. 216 Sqn. on a trip to the Middle and Far East to study the casualty evacuation service to the U.K.

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